University of Hawaii at Manoa

Hawaii Natural Energy Institute
Holmes Hall 246 • 2540 Dole Street • Honolulu, Hawaii 96822

July 18, 1991

Mr. Norman Hayashi
Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hayashi:

As required in the County of Hawaii Planning Commission's geothermal resources permit (GRP 89-1), five (5) copies of the April - June, 1991 quarterly report are enclosed.

If you have any questions, please call me at 522-5620.

Sincerely,

Harry J. Olson
Hawaiian Electric Industries/
Spark Matsunaga Fellow in
Geothermal Energy Research

Enclosure: April - June quarterly report

APRIL - JUNE 1991 QUARTERLY REPORT

Scientific Observation Hole (SOH) Program

Geothermal Resource Permit: GRP 89-1

Lilewa, Kapoho, and Halekamahina, Hawaii

TMK: 1-2-10:01; 1-4-01:02; and 1-4-02:32

Hawaii Natural Energy Institute

University of Hawaii

July 1991

I. SUMMARY

This document presents a quarterly report to the County of Hawaii Planning Department to support the Scientific Observation Hole (SOH) program in the Kilauea Middle and Lower East Rift Zones. The SOHs are for scientific observation purposes only. The information to be gained from the SOHs will provide an assessment of subsurface geological conditions, groundwater level and composition, temperature, drilling conditions, an inventory of possible mineral and geothermal resources, and an eruptive history of the island to the depth drilled.

This report addresses: description of work undertaken and planned; results of the environmental and noise monitoring activities; log of complaints; status of exploration activities; other information; and financial accounting.

II. INTRODUCTION

The County of Hawaii Planning Commission approved, on August 8, 1989, a geothermal resource permit application (GRP 89-1) to drill Scientific Observation Holes (SOHs) in the Kilauea Middle and Lower East Rift Zone. This document presents a quarterly report, as required in Condition 11:

> "The petitioner shall submit five (5) copies of a status report to the Planning Department on a quarterly basis (by the first day of January, April, July, and October of each year), or, within 30 days of the completion of any SOH. The status report shall include, but not limited to:
>
> a. A detailed description of the work undertaken during the current reporting period including drilling activity report;
> b. A description of the work being proposed over the next reporting period;
> c. The results of the environmental/noise monitoring activities;
> d. A log of the complaints received and the responses thereto;
> e. The current status of exploration activities in the context of long-range program goals; and
> f. Any other information that the Planning Department may require which will address environmental and regulatory

concerns involving the requirements of the Geothermal Resources Permit.

g. This condition shall remain in effect until all of the conditions of approval have been complied with, then after which these reports shall be every six (6) months for the duration of the project.

h. These reports shall include a financial accounting of the resources expended by the project."

III. BACKGROUND

The SOHs are for scientific observation purposes only. As designated, four holes are planned to be drilled along the Kilauea East Rift Zone on the Big Island of Hawaii. Three of the Big Island holes (SOHs 1, 2, and 4) are on agriculture land and have been permitted by the County of Hawaii Planning Commission. The fourth hole, designated SOH-3, is on conservation land. SOH activities under Conservation District Use Permit (HA 12/20/85 - 1830) issued to the Estate of James Campbell have been approved.

IV. SOH-1 SITE

Description of Current Work

Tonto Drilling Services completed drilling work at SOH-1 on January 14, 1991, when the U-5000 drilling equipment was rigged down and moved to the HGP-A site for work unrelated to the SOH project. No drilling activity was performed during this period.

Description of Proposed Work

The mud and cuttings in the sump pit will be disposed in a manner recommended by the Department of Health. The sump material is being analyzed to determine if it is suitable for disposal at the County landfill or if it should be buried on site. The site will be reclaimed to its original state after testing and monitoring are completed.

Results of the Environmental/Noise Monitoring Activities

Air Quality, Meteorological, Noise and Emissions are not being monitored, since drilling has been completed at this site.

Complaint Log and Response

Drilling completed -- no activity.

V. SOH-2 SITE

Description of Current Work

Tonto Drilling Services continued drilling activities and advanced 3,836 feet from a depth of 2,966 feet to the bottom of the hole at 6,802 feet for this reporting period. Minor caving problems were encountered in several isolated intervals. Due to the instability of the hole below 4,070 feet, a mixed casing string of 5 inch, 4-1/2 inch and CHD 134 drill rods were run to 4,103 feet and the hole was drilled with HQWL from 4,212-4,682 feet in very competent submarine volcanics, intrusives and

clastic sediments.

A faulted/sheared interval was encountered between 4,883-4,940 feet, which resulted in short core runs, dropped core and some redrilling. Core drilling then continued to a depth of 5,102 feet with full returns of drilling fluids, 10 foot core runs and 100 percent recovery. Bottom hole temperatures measured 400°F at 5,051 and 5,102 feet. Intermittent fractured and sandy intervals were encountered below 5,300 feet, although 10 foot core runs and 100 percent recovery continued to a depth of 5,400 feet.

Between 5,402 and 5,462 feet, a broken sandy formation resulted in several core runs of 6-9 feet, however, recovery remained at 100 percent. Bottom hole temperatures registered 442°F at 5,455 feet, and 445° at 5,498 feet.

While retrieving the core barrel at 5,762, the wireline broke, but after tripping out the drill rods, the core and wireline was retrieved from inside the rods. The bottom end of the wireline (3/8 inch cable) exhibited rapid deterioration due to embrittlement and fraying during the first 10 days of May as the bottom hole temperatures increased. Subsequently, the bottom 30 feet of the wireline was cut off and retied to the overshot every 2-3 days. Wireline failures do not jeopardize the hole since all hardware is retained inside the drill rods, but it does require tripping the drill rods to recover the core and hardware. A new wireline has been ordered and will be installed prior to drilling SOH-3.

Core drilling continued to 5,770 feet at which depth the drill turbo charger failed. Repairs were made to the blower shaft with a total down time of 39 hours. Drilling resumed at 6 am on May 12, 1991.

Bottom hole temperatures increased to 501°F at 5,752 feet. The temperature gradient, as reflected by the bottom hole temperatures, is higher at SOH-2 than those measured at SOH-4. Prior to the drilling of SOH-2, SOH-4 was the hottest core hole drilled on record (586°F) and also the deepest drilled for geothermal exploration purposes. Bottom hole temperatures increased steadily from 506° at 5,802 feet to 564° at 6,201 feet. This equates to a temperature gradient of 14.5°F/100 feet. The 564°F bottom hole temperature recorded at 6,201 exceeds the highest bottom hole temperature recorded at SOH-4, which was 563° measured at 6,546 feet, just prior to completing the hole to 6,562 feet.

Due to the encouraging temperatures and fluid loss in SOH-2, a request was made and approved by the Department of Land and Natural Resources to deepen the hole below the 6,500 foot depth permitted, to a maximum depth of 7,000 feet. Subsequently, SOH-2 was completed to the total depth of 6,802 feet at 1 am on May 29, 1991.

On June 2, 1991, a temperature log survey was run on SOH-2 with the United States Geological Survey logging truck. The cable head failed at 6,100 feet at a temperature of 558°F. After reheading the cable, a deviation survey was run with the Eastman-

Christensen gyroscopic survey tool. The survey indicates that SOH-2 drifted to the south at an angle of over 10 degrees from vertical at 2,000 feet, then maintained a southerly direction while slowly dropping back to a near vertical angle (less 2 degrees) by 4,500 feet. The last measurement places the hole 254 feet south and 19 feet east of the wellhead. Projected bottom hole location places the hole 270 feet south and 41 feet east of the wellhead.

On June 3, 1991, the Blow Out Preventor equipment was removed and the completion wellhead installed. The final bottom hole temperature measurement exceeded the range on the 650°F maximum reading thermometer. The estimated reading on the thermometer was 663°F at 6,802 feet. June 7 through 9, 1991, equilibrated temperature and pressures surveys were run by Pruett Industries (see Appendix A for results). Following the running of the surveys, all work terminated at SOH-2 and the Tonto rig was released for work unrelated to the SOH project on June 9, 1991.

Description of Proposed Work

The mud and cuttings in the sump pit will be disposed in a manner recommended by the Department of Health. The sump material is being analyzed to determine if it is suitable for disposal at the County landfill or if it should be buried on site. The site will be reclaimed to its original state after testing and monitoring are completed.

Results of the Environmental/Noise Monitoring Activities

Passive hydrogen sulfide (H_2S) monitors were deployed around the perimeter of the SOH-2 drill site. The Colortek sensors are replaced weekly as a matter of routine. The average H_2S level measured is about 1 ppb due to natural causes resulting from the decay of vegetation. No indication of H_2S emissions were detected from the well during this reporting period.

The air quality monitoring station provides a continuous record of atmospheric H_2S concentrations when interfaced with a data logger or chart recorder. The unit is located in a utility container on-site and power is provided by the drill rig system.

Continuous wind speed and direction measurements are made with a recording wind speed/direction sensor system. A data logger and back-up pressure-sensitive recorder collect the wind speed and direction data. The unit is located in a utility container on-site and power is provided by the drill rig system.

One noise monitoring station is located at the SOH-2 site during drilling. A second noise station is located at the Perry residence, about a third of a mile north of the SOH-2 drill site. A third noise monitoring station is located at the Hedtke residence, about 0.4 of a mile east of the SOH-2 site. The monitoring stations at both neighboring residence's were installed on February 1, 1991, and are powered by solar batteries. Minor adjustments were made during this reporting period, including chart recorder speed and battery replacement. Chart jams, which are indicative of this type of monitoring

equipment, continue to require adjustments.

Complaint Log and Response

A total of 6 noise complaints were received for the SOH-2 operations during this reporting period. Four complaints were from Jane Hedtke and two complaints came from Jennifer Perry. See Appendix C for complaint notice and response. The noise consultant analysis reports for these complaints are in Appendix D and show that SOH-2 drilling operations were within conditions set forth by the Geothermal Resource Permit (GRP 89-1).

VI. SOH-3 SITE

Description of Current Work

Drilling activity has not been initiated. Access to the SOH-3 site has not been constructed, nor has the site been cleared or graded. SOH-3 is scheduled to be located at the True/Mid-Pacific alternate Drill Site 2 (approximately 3,000 feet north-north-west of the present drill site). On May 30, 1991, a grading permit, No. 002906, was issued by the County of Hawaii Planning Department for the proposed SOH-3 site and work will proceed upon approval and notification from Governor John Waihee.

Description of Proposed Work

Grading and grubbing work for the access road and drill site will be done, prior to any drilling. Ambient noise surveys will

be conducted prior to any drilling activity.

Results of the Environmental/Noise Monitoring Activities

No drilling activity has been initiated. Ambient noise will be recorded prior to the commencement of drilling. Ambient noise levels will be recorded at, or near the homes of cooperating residents which may experience similar sound reception conditions with respect to noise sources at the drilling site.

Complaint Log and Response

Drilling activity has not been initiated. No complaints were received during this reporting period.

VII. SOH-4 SITE

Drilling Activity

Tonto Drilling Services completed drilling work at SOH-4 on May 21, 1990. No drilling activity was performed during this period. The sump material at SOH-4 was buried on site on February 24, 1991, and the site leveled to a condition that meets the landowner's (Campbell Estate) approval.

Description of Proposed Work

Various logs (i.e. temperature, pressure, and injection) will be conducted in the hole on a periodic basis.

Results of the Environmental/Noise Monitoring Activities

Air Quality, Meteorological, Noise and Emissions are not being monitored, since drilling has been completed at this site.

Complaint Log and Response

Drilling completed -- no activity.

VIII. STATUS OF CURRENT EXPLORATION ACTIVITIES

No activities are being pursued at this time.

IX. OTHER INFORMATION

No other concerns need to be addressed at this time.

X. FINANCIAL REPORT

See Appendix E for Budget status.

APPENDIX A

TEMPERATURE/PRESSURE SURVEYS

PRUETT INDUSTRIES, INC.
8905 ROSEDALE HWY. BAKERSFIELD, CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE TEMPERATURE SURVEY

CO. H.N.E.I.		RUN 01	FIELD KAPOHO		WELL SOH2
EFF DEPTH	6802'	WELL STAT	STATIC		TOOL HUNG
CASING	-	CASING PRESS			ON BOTTOM 8:24
LINER	-	TUBING PRESS			OFF BOTTOM 8:32
DATE	060691	ELEMENT RANGE	88 - 719		ZERO POINT 0'
ELEVATION		ZONE			SHUT-IN
MAX TEMP		PICK-UP	6781'		ON-PROD
PERF	-	CAL SER NO.	K1519		MPP
TUBING	-				
UNITS	ENGLISH	PURPOSE	STATIC TEMP GRADIENT 6/6/91		

SURVEY DATA

CO. H.N.E.I. RUN 01 FIELD KAPOHO WELL SOH2

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
17:01	500	88.6	0.000	18:58	5700	531.4	.143
17:07	1000	88.9	.001	19:03	5800	545.1	.137
17:14	2000	90.1	.001	19:09	5900	557.6	.125
17:21	3000	150.0	.060	19:14	6000	572.6	.150
17:30	4000	255.9	.106	19:19	6050	580.6	.160
17:35	4100	270.9	.150	19:23	6100	587.4	.135
17:41	4200	281.4	.105	19:27	6150	595.0	.154
17:46	4300	303.1	.217	19:32	6200	601.8	.134
17:51	4400	318.3	.151	19:37	6250	607.2	.109
17:56	4500	331.5	.132	19:41	6300	612.0	.096
18:02	4600	341.4	.099	19:46	6350	617.1	.102
18:08	4700	347.1	.057	19:50	6400	621.9	.096
18:13	4800	358.5	.114	19:54	6450	626.7	.096
18:18	4900	410.5	.520	19:59	6500	630.6	.077
18:23	5000	429.4	.188	20:03	6550	634.4	.077
18:28	5100	440.4	.110	20:08	6600	637.6	.064
18:33	5200	456.1	.157	20:12	6650	643.4	.115
18:38	5300	473.7	.177	20:17	6700	653.6	.205
18:43	5400	486.2	.125	20:22	6750	656.8	.064
18:48	5500	502.9	.167	20:32	6781	660.4	.114
18:53	5600	517.2	.142	0:00	0	0.0	0.000

Y STEVE WILSON

PRUETT INDUSTRIES. INC.
8905 ROSEDALE HWY. BAKERSFIELD, CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE PRESSURE SURVEY

CO. H.N.E.I.			RUN 1A FIELD KAPOHO		WELL SOH2
EFF DEPTH	6802'		WELL STAT	STATIC	TOOL HUNG
CASING		-	CASING PRESS		ON BOTTOM 8:24
LINER		-	TUBING PRESS		OFF BOTTOM 8:32
DATE	060691		ELEMENT RANGE	0 - 4137	ZERO POINT 0'
ELEVATION			ZONE		SHUT-IN
MAX TEMP			PICK-UP	6781'	ON-PROD
PERF		-	CAL SER NO.	16430	MPP
TUBING		-			
UNITS	ENGLISH		PURPOSE	STATIC PRESS GRADIENT 6/6/91	

SURVEY DATA

CO. H.N.E.I. RUN 1A FIELD KAPOHO WELL SOH2

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
17:01	500	119.1	0.000	18:58	5700	2296.8	.395
17:07	1000	333.3	.428	19:03	5800	2336.3	.395
17:14	2000	763.0	.430	19:09	5900	2375.7	.394
17:21	3000	1193.4	.430	19:14	6000	2415.2	.394
17:30	4000	1623.2	.430	19:19	6050	2433.9	.374
17:35	4100	1664.5	.413	19:23	6100	2452.5	.373
17:41	4200	1705.8	.413	19:27	6150	2471.2	.374
17:46	4300	1745.1	.393	19:32	6200	2489.9	.373
17:51	4400	1784.4	.393	19:37	6250	2508.5	.373
17:56	4500	1823.7	.393	19:41	6300	2527.2	.373
18:02	4600	1863.1	.393	19:46	6350	2545.9	.373
18:08	4700	1902.4	.394	19:50	6400	2564.5	.373
18:13	4800	1941.8	.394	19:54	6450	2583.1	.373
18:18	4900	1981.2	.394	19:59	6500	2601.8	.373
18:23	5000	2020.6	.394	20:03	6550	2620.4	.373
18:28	5100	2060.1	.394	20:08	6600	2639.1	.373
18:33	5200	2099.5	.394	20:12	6650	2657.7	.372
18:38	5300	2139.0	.394	20:17	6700	2676.3	.372
18:43	5400	2178.4	.395	20:22	6750	2694.9	.372
18:48	5500	2217.9	.395	20:32	6781	2707.3	.400
18:53	5600	2257.4	.395	0:00	0	0.0	0.000

' STEVE WILSON

PRUETT INDUSTRIES. INC.
8905 ROSEDALE HWY. BAKERSFIELD. CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE TEMPERATURE SURVEY

CO. H.N.E.I.		RUN 02	FIELD KAPOHO		WELL SOH2
EFF DEPTH		WELL STAT	INJ		TOOL HUNG
CASING	-	CASING PRESS			ON BOTTOM 13:50
LINER	-	TUBING PRESS			OFF BOTTOM 14:00
DATE	060791	ELEMENT RANGE	88 -	719	ZERO POINT 0'
ELEVATION		ZONE			SHUT-IN
MAX TEMP		PICK-UP	6782'		ON-PROD
PERF	-	CAL SER NO.	K1519		MPP
TUBING	-				
UNITS	ENGLISH	PURPOSE	INJECTING TEMP GRADIENT 6/7/91		

SURVEY DATA

CO. H.N.E.I. RUN 02 FIELD KAPOHO WELL SOH2

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
11:35	1800	88.0	0.000	12:53	5700	529.5	.146
11:43	3000	126.7	.032	13:05	5800	543.2	.137
11:53	4127	250.9	.110	13:10	5900	557.0	.137
11:59	4500	314.6	.171	13:15	6000	570.7	.138
12:07	4850	395.4	.231	13:20	6100	585.4	.147
12:15	5000	428.1	.218	13:25	6200	598.6	.131
12:20	5100	438.5	.104	13:30	6300	611.4	.128
12:25	5200	454.5	.160	13:35	6400	622.6	.112
12:31	5300	470.3	.158	13:40	6500	630.9	.083
12:36	5400	484.7	.144	13:45	6600	638.6	.077
12:41	5500	500.1	.154	13:50	6700	654.3	.157
12:47	5600	514.9	.149	14:00	6782	660.4	.074

HUT DOWN WELL @ 12:49 - HOSE BROKE
EGAN INJECTING AGAIN @ 12:57
NJ RATE : 50-55 bpm
/ STEVE WILSON

PRUETT INDUSTRIES. INC.
8905 ROSEDALE HWY. BAKERSFIELD. CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE PRESSURE SURVEY

CO. H.N.E.I.		RUN 03	FIELD KAPOHO	WELL SOH2	
EFF DEPTH		WELL STAT	INJ/SI	TOOL HUNG	4500'
CASING	-	CASING PRESS		ON BOTTOM	15:37 6/7
LINER	-	TUBING PRESS		OFF BOTTOM	7:00 6/8
DATE	060791	ELEMENT RANGE	0 - 4137	ZERO POINT	0'
ELEVATION		ZONE		SHUT-IN	19:30 6/7
MAX TEMP		PICK-UP		ON-PROD	
PERF	-	CAL SER NO.	16430	MPP	
TUBING	-				
UNITS	ENGLISH	PURPOSE	STEP-RATE / FALL-OFF		

SURVEY DATA

CO. H.N.E.I. RUN 03 FIELD KAPOHO WELL SOH2

TIME	P-T	DP-DT	DTIME	TIME	P-T	DP-DT	DTIME
15:37	1802.7	0.0	0.0	17:10	2062.8	260.2	1.5
15:47	1812.8	10.1	.2	17:13	2062.7	260.1	1.6
15:57	1811.1	8.4	.3	17:15	2065.4	262.7	1.6
16:07	1809.4	6.7	.5	17:17	2068.2	265.6	1.7
16:17	1808.9	6.3	.7	17:22	2073.1	270.4	1.7
16:27	1807.0	4.4	.8	17:27	2070.3	267.6	1.8
16:29	1807.0	4.3	.9	17:33	2061.8	259.2	1.9
16:29	1960.1	157.4	.9	17:37	2058.8	256.2	2.0
16:30	2077.1	274.4	.9	17:42	2057.4	254.8	2.1
16:31	2085.6	282.9	.9	17:47	2055.0	252.4	2.2
16:32	2095.7	293.1	.9	17:52	2050.8	248.1	2.2
16:33	2105.9	303.2	.9	17:57	2050.6	248.0	2.3
16:35	2113.7	311.0	1.0	18:00	2050.6	247.9	2.4
16:36	2121.4	318.7	1.0	18:01	2125.9	323.2	2.4
16:38	2121.3	318.7	1.0	18:02	2230.6	427.9	2.4
16:39	2121.3	318.6	1.0	18:03	2284.1	481.5	2.4
16:39	2097.6	295.0	1.0	18:05	2284.1	481.4	2.5
16:40	2079.1	276.5	1.0	18:06	2284.4	481.8	2.5
16:41	2063.3	260.7	1.1	18:08	2293.1	490.5	2.5
16:43	2059.1	256.5	1.1	18:11	2298.2	495.6	2.6
16:44	2057.0	254.4	1.1	18:14	2305.2	502.6	2.6
16:46	2057.0	254.3	1.1	18:15	2318.3	515.6	2.6
16:48	2056.9	254.3	1.2	18:17	2330.3	527.7	2.7
16:50	2056.9	254.2	1.2	18:18	2324.2	521.6	2.7
16:53	2056.8	254.2	1.3	18:21	2357.6	555.0	2.7
16:55	2056.7	254.1	1.3	18:23	2333.3	530.6	2.8
16:57	2056.7	254.0	1.3	18:24	2357.1	554.5	2.8
17:00	2059.5	256.9	1.4	18:26	2356.6	554.0	2.8
17:04	2059.6	257.0	1.5	18:29	2377.3	574.7	2.9
17:06	2059.6	256.9	1.5	18:30	2312.7	510.1	2.9

SURVEY DATA

CO. H.N.E.I. RUN 03 FIELD KAPOHO WELL SOH2

TIME	P-T	DP-DT	DTIME	TIME	P-T	DP-DT	DTIME
18:32	2285.5	482.8	2.9	20:24	1831.0	28.3	4.8
18:35	2281.7	479.0	3.0	20:28	1830.9	28.2	4.8
18:38	2271.2	468.6	3.0	20:32	1830.8	28.2	4.9
18:41	2275.9	473.3	3.1	20:36	1830.7	28.0	5.0
18:43	2275.9	473.2	3.1	20:42	1830.5	27.9	5.1
18:46	2275.8	473.1	3.2	20:49	1830.0	27.3	5.2
18:50	2275.7	473.0	3.2	20:59	1829.7	27.1	5.4
18:52	2275.6	473.0	3.2	21:04	1829.0	26.3	5.4
18:53	2037.0	234.4	3.3	21:08	1828.9	26.2	5.5
18:54	2223.5	420.8	3.3	21:17	1828.7	26.0	5.7
18:56	2032.8	230.2	3.3	21:27	1828.4	25.8	5.8
18:56	2185.4	382.7	3.3	21:37	1828.2	25.5	6.0
18:59	2282.6	479.9	3.4	21:47	1828.1	25.5	6.2
19:00	2282.5	479.9	3.4	21:57	1827.9	25.2	6.3
19:01	2274.8	472.2	3.4	22:07	1827.4	24.8	6.5
19:03	2284.7	482.1	3.4	22:17	1827.2	24.5	6.7
19:05	2282.2	479.5	3.5	22:27	1826.9	24.3	6.8
19:06	2286.3	483.6	3.5	22:37	1826.7	24.0	7.0
19:08	2276.9	474.3	3.5	22:47	1826.4	23.8	7.2
19:08	2291.9	489.2	3.5	22:57	1826.2	23.5	7.3
19:11	2291.8	489.1	3.6	23:07	1826.0	23.3	7.5
19:14	2291.7	489.1	3.6	23:17	1825.7	23.1	7.7
19:17	2302.2	499.6	3.7	23:27	1825.5	22.8	7.8
19:19	2302.2	499.5	3.7	23:37	1825.2	22.6	8.0
19:21	2302.1	499.5	3.7	23:47	1825.0	22.3	8.2
19:23	2302.1	499.4	3.8	23:57	1824.7	22.1	8.3
19:24	2296.6	494.0	3.8	0:07	1824.5	21.8	8.5
19:27	2310.9	508.3	3.8	0:17	1824.2	21.6	8.7
19:30	2310.8	508.2	3.9	0:27	1824.0	21.3	8.8
19:31	1877.7	75.0	3.9	0:37	1823.7	21.1	9.0
19:33	1844.9	42.2	3.9	0:47	1823.5	20.8	9.2
19:36	1836.0	33.3	4.0	0:57	1823.2	20.6	9.3
19:39	1834.8	32.1	4.0	1:07	1823.2	20.6	9.5
19:42	1834.4	31.7	4.1	1:17	1823.2	20.5	9.7
19:45	1834.1	31.4	4.1	1:27	1822.9	20.3	9.8
19:48	1833.8	31.2	4.2	1:38	1822.7	20.0	10.0
19:50	1833.5	30.8	4.2	1:47	1822.4	19.8	10.2
19:53	1833.2	30.5	4.3	1:57	1822.4	19.7	10.3
19:57	1832.9	30.2	4.3	2:07	1821.9	19.3	10.5
20:01	1832.5	29.8	4.4	2:18	1821.7	19.0	10.7
20:05	1831.9	29.2	4.5	2:27	1821.4	18.8	10.8
20:09	1831.5	28.8	4.5	2:37	1821.0	18.4	11.0
20:14	1831.3	28.6	4.6	2:47	1821.0	18.3	11.2
20:17	1831.2	28.5	4.7	2:51	1820.9	18.2	11.2
20:21	1831.1	28.4	4.7	0:00	0.0	0.0	0.0

EGIN INJECTING 16:25 6/7 @ 3.5 BLS/MIN
NCREASE RATE @ 18:01 6/7 TO 6.0 BLS/MIN
HUT-IN @ 19:30 6/7/91
Y STEVE WILSON

PRUETT INDUSTRIES. INC.
8905 ROSEDALE HWY. BAKERSFIELD. CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE TEMPERATURE SURVEY

CO. H.N.E.I.			RUN 04 FIELD KAPOHO		WELL SOH2
EFF DEPTH			WELL STAT	STATIC	TOOL HUNG
CASING		-	CASING PRESS		ON BOTTOM 11:19
LINER		-	TUBING PRESS		OFF BOTTOM 11:25
DATE	060891		ELEMENT RANGE	88 - 719	ZERO POINT 0'
ELEVATION			ZONE		SHUT-IN
MAX TEMP			PICK-UP	6725'	ON-PROD
PERF		-	CAL SER NO.	K1519	MPP
TUBING		-			
UNITS	ENGLISH		PURPOSE	STATIC TEMP GRADIENT 6/8/91	

SURVEY DATA

CO. H.N.E.I. RUN 04 FIELD KAPOHO WELL SOH2

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
8:30	1000	89.2	0.000	10:00	5300	469.1	.161
8:37	2000	90.7	.002	10:05	5400	484.4	.153
8:44	3000	141.1	.050	10:10	5500	499.5	.151
8:53	4000	235.3	.094	10:15	5600	515.6	.161
8:58	4100	248.6	.133	10:21	5700	530.2	.146
9:03	4200	258.4	.098	10:27	5800	543.2	.131
9:09	4300	305.6	.471	10:32	5900	556.6	.134
9:14	4400	318.9	.133	10:37	6000	570.1	.134
9:19	4500	325.8	.069	10:45	6100	585.1	.150
9:25	4600	336.6	.108	10:50	6200	598.9	.138
9:30	4700	346.2	.096	10:56	6300	609.5	.106
9:35	4800	355.8	.096	11:01	6400	624.5	.150
9:40	4900	401.4	.456	11:06	6500	632.8	.083
9:45	5000	424.2	.227	11:12	6600	641.5	.086
9:50	5100	437.0	.128	11:17	6700	651.4	.099
9:55	5200	453.0	.160	11:25	6725	655.6	.167

BY STEVE WILSON

PRUETT INDUSTRIES. INC.
8905 ROSEDALE HWY. BAKERSFIELD. CA. 93312
(805) 589-2768 TELEX 4992440 PRUETT INT.

SUB-SURFACE PRESSURE SURVEY

CO. H.N.E.I.			RUN 4A FIELD KAPOHO		WELL SOH2
EFF DEPTH			WELL STAT	STATIC	TOOL HUNG
CASING		-	CASING PRESS		ON BOTTOM
LINER		-	TUBING PRESS		OFF BOTTOM
DATE	060891		ELEMENT RANGE	0 - 4137	ZERO POINT 0'
ELEVATION			ZONE		SHUT-IN
MAX TEMP			PICK-UP	6725'	ON-PROD
PERF		-	CAL SER NO.	16430	MPP
TUBING		-			
UNITS	ENGLISH		PURPOSE	STATIC PRESS GRADIENT 6/8/91	

SURVEY DATA

CO. H.N.E.I. RUN 4A FIELD KAPOHO WELL SOH2

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
8:30	1000	422.7	0.000	8:53	4000	1633.6	.393
8:37	2000	832.8	.410	11:25	6725	2670.1	.380
8:44	3000	1240.6	.408	0:00	0	0.0	0.000

BY STEVE WILSON

APPENDIX B

SOH-2 DAILY DRILLING REPORTS

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 3/31/91
Period End: 0700 4/1/91
Depth Start: 2,966 ft.
Depth End: 3,097 ft.
Footage: 131 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT N/A
LC @

Date: 4-1-91
Spud Date: 02-04-91
Day #: 57
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: K.E.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.E.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Drill 5-7/8 inch hole 2,966 - 3,097 feet without returns of drilling fluids. Fluid level remains near the surface with minor returns at increased pumping rates. Formation generally hard with penetration rates of about 5 feet per hour. Softer, broken intervals 2,978 - 2,982 feet and 3,030 - 3,070 feet. High torque and minor sticking 3,040 - 3,070 feet. Pumping several high viscosity mud sweeps reduced torque to normal range and eliminated sticking.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,097	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/1/91
Period End: 0700 4/2/91
Depth Start: 3,097 ft.
Depth End: 3,224 ft.
Footage: 127 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT 81
LC @

Date: 4-2-91
Spud Date: 02-04-91
Day #: 58
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: K.E.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Drl 5-7/8 inch hole 3,097 - 3,224 feet without returns of drilling fluids. Below 3,150 feet, torque began increasing and minor sticking occured after adding rods. Swept hole with high vis mud at 3,165 feet and torque dropped to normal range. Bottom hole temperature measurements at 3,120 and 3,224 feet were below the 100F minimum reading on the maximum reading thermometer.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,224	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/2/91
Period End: 0700 4/3/91
Depth Start: 3,224 ft.
Depth End: 3,381 ft.
Footage: 157 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 71 OUT N/A
LC @

Bits:

Date: 4-3-91
Spud Date: 02-04-91
Day #: 59
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: K.E.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Drill 5-7/8 inch hole 3,224 - 3,381 feet without returns of drilling fluids. Fluid level remains near the surface with minor returns at increased pumping rates. Penetration rates vary from 5 - 9 feet per hour. Bottom hole temperature measurements at 3,278 and 3,357 feet were below the 100 F minimum reading on the maximum reading thermometers.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,381	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/3/91
Period End: 0700 4/4/91
Depth Start: 3,381 ft.
Depth End: 3,497 ft.
Footage: 116 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 85 OUT N/A
LC @

Bits:

Date: 4-4-91
Spud Date: 02-04-91
Day #: 60
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper:
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Drl 5-7/8 inch hole 3,381 - 3,497 feet without returns of drilling fluids. Poorly consolidated intervals at 3,381-3,396 feet, 3,461 - 3,464 feet and 3,469 - 3,478 feet. Clean and stabalize hole with several redrills and sweeping hole with high vis mud. Bottom hole temperature measurement at 3,435 feet was below the 100 F minimum reading on the maximum reading thermometer.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,497	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/4/91
Period End: 0700 4/5/91
Depth Start: 3,497 ft.
Depth End: 3,594 ft.
Footage: 97 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 76 OUT N/A
LC @

Date: 4-5-91
Spud Date: 02-04-91
Day #: 61
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.A.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Drill 5-7/8 inch hole 3,497 - 3,594 feet without returns of drilling fluids. Fluid level remains near the surface. Penetration rates vary from 4 - 7 feet per hour. Soft, caving and unastable interval 3,571 - 3,590 feet which required several redrills to clean and stabalize. Bottom hole temperature measurement at 3,514 feet was below the 100 F minimum reading on the maximum reading thermometer.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,594	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/5/91
Period End: 0700 4/6/91
Depth Start: 3,594 ft.
Depth End: 3,695 ft.
Footage: 101 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 86
LC @

Bits:

Date: 4-6-91
Spud Date: 02-04-91
Day #: 62
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Drl 5-7/8 inch hole 3,594 - 3,695 feet with minor returns, increasing to approximately 20% at 3,695 feet. Minor caving 3,504 - 3,506 feet which required several redrills. Rod torque increased about 50 percent below 3,670 feet. After running several high vis mud sweeps and redrilling interval, torque decreased to normal range. Bottom hole temperature at 3,632 feet was 100 F.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,695	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/6/91
Period End: 0700 4/7/91
Depth Start: 3,695 ft.
Depth End: 3,770 ft.
Footage: 75 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 82 OUT 87
LC @

Date: 4-7-91
Spud Date: 02-04-91
Day #: 63
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits: 5-7/8" ATJ-33 #A57537H
on at 3,711 feet.

Additional Information: Drill 5-7/8 inch hole 3,695 - 3,711 feet with approximately 25 percent return of drilling fluids. Condition hole and trip out of hole for bit change. Bit had 185 hours of drilling time and cut 881 feet of new hole. Trip in hole, reaming required at two small intervals (2,816 - 2,820 feet and 2,958 - 2,960 feet) and cave was encountered from 3,667 - 3,770 feet. Drill 5-7/8 inch hole 3,711 - 3,770 feet with approximately 25 percent return of drilling fluids.

Bottom hole temperature measurements at 3,711 and 3,770 feet were at the 100 F minumum reading on the maximum reading thermometers.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,770	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/7/91
Period End: 0700 4/8/91
Depth Start: 3,770 ft.
Depth End: 3,963 ft.
Footage: 193 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 82 OUT 88
LC @

Bits:

Date: 4-8-91
Spud Date: 02-04-91
Day #: 64
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Drill 5-7/8 inch hole 3,770 - 3,963 feet with returns increasing to 50 - 60 percent. Bottom hole temperature measurements or 104 F were recorded at 3,848 and 3,907 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 3,963	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/8/91
Period End: 0700 4/9/91
Depth Start: 3,963 ft.
Depth End: 4,082 ft.
Footage: 119 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in N/A 40
Mud pH: 9.0
Mud Temp (F): IN 82 OUT 89
LC @

Date: 4-9-91
Spud Date: 02-04-91
Day #: 65
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Daymond

Bits:

Additional Information: Drl 5-7/8 inch hole 3,963 - 4,082 feet with approximately 60 percent drilling fluid returns. Interval from 4,020 - 4,047 feet fairly unstable, some caving, minor sticking and required several redrills to condition. Bottom hole temperatures of 112 F at 3,987 feet and 120 F at 4,045 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,082	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/9/91
Period End: 0700 4/10/91
Depth Start: 4,082 ft.
Depth End: 4,103 ft.
Footage: 21 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 47 in 42 out
Mud pH: 9.0
Mud Temp (F): IN 82 OUT 88
LC @

Date: 4-10-91
Spud Date: 02-04-91
Day #: 66
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Drill 5-7/8 inch hole 4,082 - 4,103 feet with approximately 60 percent drilling fluid returns. While swabbing bottom 20 feet of hole prior to adding drill rod, the 134mm drill rod separated at 1,878 feet while 10 feet off bottom. Trip out of hole, pick up overshot, trip in hole and recover fish (2,225 feet of 134mm drill rods and 5-5/8" bit) on first attempt. Fish pulled free with pull of only 10,000 pounds over drill string weight. Bit appears undamaged by drop, rerun same bit, encountered fill at 4,063 feet. Wash and ream hole three times, stick rods briefly, pull back to 4,063 feet and continue washing and reaming.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/10/91
Period End: 0700 4/11/91
Depth Start: 4,103 ft.
Depth End: 4,103 ft.
Footage: ft.
Mud Wt: 8.4 #/gal
Vis (sec): 49 in N/A 45
Mud pH: 9.0
Mud Temp (F): IN 82 OUT 86
LC @

Bits:

Date: 4-11-91
Spud Date: 02-04-91
Day #: 67
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: R.U.
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Unable to clean and stabalize interval between 4,060 and 4,073 feet. Wash and ream repeatedly with 60 - 70 percent returns. Returns carrying considerable amounts of fine sand/cuttings. Stick rods briefly, pull back into casing, wash back to 4,073 feet, encounter same problem, trip out of hole and prepare to run casing.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/11/91
Period End: 0700 4/12/91
Depth Start: 4,103 ft.
Depth End: 4,103 ft.
Footage: ft.
Mud Wt: 8.4 #/gal
Vis (sec): 48 in 42 out
Mud pH: 9.0
Mud Temp (F): IN 82 OUT N/A
LC @

Date: 4-12-91
Spud Date: 02-04-91
Day #: 68
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: R.U.
Helper: K.K.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits: 3-15/16" tricone NSN

Additional Information: Run casing string consisting of: 382 feet of 15#, K-55 left hand threaded, flush joint casing; 1,927 feet of 10.5#, J-55 BT&C casing; and 1,794 feet of 134mm drill rod. The top of the 134mm x 7" annular space is sealed off with a donut and LCM. A second donut is spotted at the top of the 4-1/2" casing. At the completion of core drilling and after injection testing, the 134mm drill rods will be backed off at a left hand cross over at the 134mm x 4-1/2" connection and recovered.

The casing was lowered to 4,050 feet and washed into to 4,073 feet. Below 4,073 feet, pump pressure increased to 900 psi and circulation could not be maintained. Repeated attempts to wash in deeper were unsuccessful. The casing was then lowered thru the sanded in interval to TD without pumping. The casing will be cleaned out with a 3-15/16 inch tricone bit prior to commencing core drilling with HQWL (3.83 inch hole x 2.5 inch core).

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	N/A N/A	N/A

V

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/12/91
Period End: 0700 4/13/91
Depth Start: 4,103 ft.
Depth End: 4,152 ft.
Footage: 49 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in N/A 43
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 85
LC @

Date: 4-13-91
Spud Date: 02-04-91
Day #: 69
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits: Huddy "orange" #15766-4
@ 4,108 feet.

Additional Information: Clean out 4-1/2 inch casing with a 3-15/16 inch tricone and deepen hole to 4,108 feet. Trip out of hole, pick up HQWL coring assembly and trip in hole. Core HQ 4,108 - 4,152 feet in 12 hours with full return of drilling fluids. Core runs averaged 7 - 10 feet and the core is noticeably warm to the touch. Bottom hole temperature of 206 F measured at 4,152 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(tenporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,152	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/13/91
Period End: 0700 4/14/91
Depth Start: 4,152 ft.
Depth End: 4,212 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in 42 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 85
LC @

Date: 4-14-91
Spud Date: 02-04-91
Day #: 70
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core with HQ 4,152 - 4,212 feet with full returns. Core runs vary from 5 - 10 feet. Progress was slowed when a piece of core fell from the inner tube while being retrieved and wedged in the drill rods. Several hours were required to trip drill rods out of the hole to remove the blockage. A bottom hole temperature of 206 F was recorded at 4,200 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
4.83"	4,103 to 4,212	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/14/91
Period End: 0700 4/15/91
Depth Start: 4,212 ft.
Depth End: 4,272 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in N/A 43
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 86
LC @

Date: 4-15-91
Spud Date: 02-04-91
Day #: 71
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Daymonaz

Bits:

Additional Information: Core HQ 4,212 - 4,262 feet with full returns and 6 - 10 foot core runs with 100% recovery. Drill rods seperated at 1,880 feet, trip rods out of hole, run in hole with Bolen spear and retrieve remaining drill rods on first attempt. Bit in good shape, rerun and trip back in hole and hole. Core HQ 4,262 - 4,272 feet with full returns of drilling fluids. Bottom hole temperature of 226 F recorded at 4,262 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
	(temporary)	5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,262	N/A	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/15/91
Period End: 0700 4/16/91
Depth Start: 4,272 ft.
Depth End: 4,362 ft.
Footage: 90 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in N/A 43
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 85
LC @

Date: 4-16-91
Spud Date: 02-04-91
Day #: 72
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core HQ 4,272 - 4,362 feet with full returns of drilling fluids. Core runs 10 feet with 100 percent recovery. Bottom hole temperature measurements of 239 F at 4,311 feet and 232 F at 4,352 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
	(temporary)	5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,362	N/A	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/16/91
Period End: 0700 4/17/91
Depth Start: 4,362 ft.
Depth End: 4,452 ft.
Footage: 90 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 46 in 42 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 85
LC @

Date: 4-17-91
Spud Date: 02-04-91
Day #: 73
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core with HQ 4,362 - 4,452 feet with full returns. Core runs all 10 feet with 100 percent recovery. Bottom hole temperature measurements of 248 F at 4,402 feet and 240 F at 4,452 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
4.83"	4,103 to 4,452	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/17/91
Period End: 0700 4/18/91
Depth Start: 4,452 ft.
Depth End: 4,512 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 47 in 44 out
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 85
LC @

Date: 4-18-91
Spud Date: 02-04-91
Day #: 74
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core with HQ 4,452 - 4,512 feet with full returns. Core runs all 10 feet with 100 percent recovery. Bottom hole temperature of 270 F recorded at 4,502 feet.

At 9:30 PM, while drilling, the main rig motor suddenly died. The Detroit Diesel service man was notified and repairs are anticipated to be completed by 7 PM on April 18 if the necessary repair parts can be located in state. This is the first major problem in over 20,000 hours of operating time on this particular engine.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
4.83"	4,103 to 4,512	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/18/91
Period End: 0700 4/19/91
Depth Start: 4,512 ft.
Depth End: 4,572 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 48 in 45 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Date: 4-19-91
Spud Date: 02-04-91
Day #: 75
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Complete repairs to blower unit on rig motor at 2 PM. Resume coring without incident and core HQ 4,512 - 4,572 feet with full return of drilling fluids to 4,560 feet. Below 4,560 feet returns dropped to approximately 75 percent. Bottom hole temperature of 284 F recorded at 4,552 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
4.83"	4,103 to 4,572	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/19/91
Period End: 0700 4/20/91
Depth Start: 4,572 ft.
Depth End: 4,622 ft.
Footage: 50 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 44 in 41 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 80
LC @

Date: 4-20-91
Spud Date: 02-04-91
Day #: 76
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: N.L.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core HQ 4,572 - 4,622 feet with approximately 75 percent return of drilling fluids. While drilling at 4,622 feet, drill rods separated at 1,890 feet. After tripping upper section of rods out of hole, the remaining drill rods were fished out on first attempt and bit was changed. Trip back in hole and resume core drilling. Bottom hole temperature of 276 F recorded at 4,602 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,622	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/20/91
Period End: 0700 4/21/91
Depth Start: 4,622 ft.
Depth End: 4,682 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 43 in N/A 40
Mud pH: 9.0
Mud Temp (F): IN 83 OUT 83
LC @

Date: 4-21-91
Spud Date: 02-04-91
Day #: 77
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core HQ 4,622 - 4,682 feet with 60 - 75 per ent return of drilling fluids. Core runs 10 feet with 100 percent recovery. Bottom hole temperature of 294 F recorded at 4,662 feet. While drilling past 4,682 feet the drill rods separated at 1,870 feet. The drill rods were retrieved on the first attempt, then tripped back in to resume drilling.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
	(temporary)	5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,682	N/A	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/21/91
Period End: 0700 4/22/91
Depth Start: 4,682 ft.
Depth End: 4,739 ft.
Footage: 57 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 83 OUT 83
LC @

Date: 4-22-91
Spud Date: 02-04-91
Day #: 78
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Cunningham
Helper: J.K.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: R.U.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Rotate drill rods from 1,900 - 2,300 foot interval to the 1,500 - 1,900 foot interval. Finish tripping in hole and resume drilling at noon. Core drill HQ 4,682 - 4,739 feet A bottom hole temperature of 306 F was recorded at 4,712 feet.

While drilling below 4,739 feet the drill rods separated at 1,900 feet. Pull out of hole and recover remaining drill rods on first attempt. Upper section of HQ drill rods will be replaced by 101mm drill rods. The 101mm rods have a much higher joint strength and are in 20 foot rather than 10 foot sections as are the HQ rods.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
4.83"	4,103 to 4,739	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SDH-2
Period Start: 0700 4/22/91
Period End: 0700 4/23/91
Depth Start: 4,739 ft.
Depth End: 4,815 ft.
Footage: 76 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in 35 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 81
LC @

Date: 4-23-91
Spud Date: 02-04-91
Day #: 79
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Trip back in hole with mixed drill string of HQ and 101mm rods. The 101mm rods will be used in the dogleg section below 1,860 feet. Core HQ 4,739 - 4,815 feet with 75 percent returns of drilling fluids. Excessive torque while rotating the drill rods requires a 50 percent reduction in rotation speed. The drill crew is currently experimenting with various mixtures of high temperature polymers to reduce torque. The sharp dogleg and deviated hole increase drill rod/bore hole wall contact while the rapidly increasing hole temperatures reduce the drilling fluids lubricity resulting in high torque.

Bottom hole temperature of 332 F recorded at 4,760 feet and 298 F recorded at 4,805 feet. Decrease in final measurement most likely results from small fractured interval which allowed drilling fluids to migrate away from bore hole, cooling the formation.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,815	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/23/91
Period End: 0700 4/24/91
Depth Start: 4,815 ft.
Depth End: 4,888 ft.
Footage: 73 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in N/A 34
Mud pH: 9.0
Mud Temp (F): IN 83 OUT 84
LC @

Bits:

Date: 4-24-91
Spud Date: 02-04-91
Day #: 80
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Core HQ 4,815 - 4,888 feet with 60 - 75 percent return of drilling fluids. While drilling past 4,888 feet, the 101mm drill rods separated at 1,880 feet. Trip rods out of hole and trip in with spear to recover remaining rods.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,888	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/24/91
Period End: 0700 4/25/91
Depth Start: 4,888 ft.
Depth End: 4,912 ft.
Footage: 24 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 83
LC @

Date: 4-25-91
Spud Date: 02-04-91
Day #: 81
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Recover drill rods, trip back i hole and core HQ 4,888 - 4,912 feet. Below 4,883 feet, formation becomes broken and sandy. Extensive shearing indicates the hole is passing through a fault zone. The broken nature of the formation is resulting in core runs of 3 - 7 feet with some problems with dropped core and minor caving.

Bottom hole temperature of 348 °F recorded at 4,902 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
	(temporary)	5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,912	N/A	N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/25/91
Period End: 0700 4/26/91
Depth Start: 4,912 ft.
Depth End: 4,950 ft.
Footage: 38 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A 36
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 84
LC @

Bits:

Data: 4-26-91
Spud Date: 02-04-91
Day #: 82
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Daymonaz

Additional Information: Core HQ 4,912 - 4,950 feet with 60 - 70 percent return of drilling fluids. From approximately 4,883 - 4,940 feet the formation has been fractured and sandy. The intense shearing is indicative of a fault zone. At 4,940 feet conditions improved and the final 10 feet drilled was solid and competant.

While drilling past 4,950 feet, the 101mm drill rods separated at 1,880 feet. Trip rods out of hole and trip in with spear to recover remaining rods. o

Bottom hole temperature of 320 F recorded at 4,950 feet. Depressed temperature likely due to fluid loss in this interval and does not reflect a decrease in formation temperature.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,950	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/26/91
Period End: 0700 4/27/91
Depth Start: 4,950 ft.
Depth End: 4,959 ft.
Footage: 9 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 84
LC @

Date: 4-27-91
Spud Date: 02-04-91
Day #: 83
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits: HQ #L-77687 @ 4,950 ft.

Additional Information: Recover drill rods and change bit. While making wet pull, two damaged drill rods were discovered in lower 100 feet of drill string. One rod was split up both sides of the box. Trip back in hole and wash cave from 4,915 - 4,950 feet. Considerable amount of sand from fault zone washed out of hole. Begin coring HQ at 05:00 and core 4,950 - 4,959 feet in competent formation.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/27/91
Period End: 0700 4/28/91
Depth Start: 4,959 ft.
Depth End: 4,988 ft.
Footage: 29 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A 36
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 84
LC @

Date: 4-28-91
Spud Date: 02-04-91
Day #: 84
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core HQ 4,959 - 4,988 feet with 80 percent return of drilling fluids. Formation has been competent below 4,940 feet after exiting a fault zone with intense shearing. An additional 3,000 pounds of weight was being run on the bit in an effort to reduce tensional stress at the 1,880 foot dogleg. However, the 101mm drill rods separated again at the 1,880 feet while coring below 4,988 feet.

The rods were recovered and the decision was made to reduce to NQ. The NQ rods are smaller and more flexable than the HMQ and 101mm rods used thus far. After running HMQ to 4,988 feet and setting on bottom, the BOP stack was removed and both the 4-1/2 inch casing string and HMQ string were tensioned and hung below the wellhead flange. This will place the upper 2,200 feet of casing in tension and minimize the curvature around the dogleg at 1,880 feet.

The BOP stack was nipped up, and the NQ drilling assembly made up.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/28/91
Period End: 0700 4/29/91
Depth Start: 4,988 ft.
Depth End: 5,011 ft.
Footage: 23 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 83
LC @

Date: 4-29-91
Spud Date: 02-04-91
Day #: 85
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits: NQ #L-74590 @ 4,988 ft.

Additional Information: Complete nippling up BOP stack and inspection of NQ drill rods. Trip in hole with NQ drilling assembly. Core NQ 4,988 - 5,011 feet in competent formation with 100 percent core recovery. Bottom hole temperature of 411 F recorded at 5,001 feet.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
	(temporary)	5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988) temp.	HMQ/7.7#
2.98"	4,988 to 5,011	N/A N/A	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/29/91
Period End: 0700 4/30/91
Depth Start: 5,011 ft.
Depth End: 5,102 ft.
Footage: 91 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Bits:

Date: 4-30-91
Spud Date: 02-04-91
Day #: 86
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Core NQ 5,011 - 5,102 feet with full returns of drilling fluids, 10 foot core runs and 100 percent recovery. Bottom hole temperature measurements of 400 F at 5,051 and 5,102 feet.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,102	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 4/30/91
Period End: 0700 5/1/91
Depth Start: 5,102 ft.
Depth End: 5,201 ft.
Footage: 99 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 39 in N/A 36
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-1-91
Spud Date: 02-04-91
Day #: 87
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Daymonaz

Bits:

Additional Information: Core NQ 5,102 - 5,201 feet with full returns of drilling fluids and 100 percent recovery. Minor vibration problems resulting from formation temperatures breaking down polymer drilling fluids. Addition of Torkease to increase lubricity eliminated problem.

Bottom hole temperature measurements: 414 F at 5,150 feet and 409 F at 5,201 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,201	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/1/91
Period End: 0700 5/2/91
Depth Start: 5,201 ft.
Depth End: 5,272 ft.
Footage: 71 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 77
LC @

Date: 5-2-91
Spud Date: 02-04-91
Day #: 88
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,201 - 5,272 feet with approximately 75 percent return of drilling fluids. Fluid return gradually declined during the past 24 hours in fractured formation. Core runs continue to average 10 feet with 100 percent recovery. Bottom hole temperature measurement of 422 F at 5,252 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,272	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/2/91
Period End: 0700 5/3/91
Depth Start: 5,272 ft.
Depth End: 5,342 ft.
Footage: 70 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in N/A 33
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 77
LC @

Date: 5-3-91
Spud Date: 02-04-91
Day #: 89
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,272 - 5,242 feet with approximately 75 percent return of drilling fluids. Core recovery is 100 percent with 10 foot core runs. Bottom hole temperature of 438 F recorded at 5,302 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,201	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/3/91
Period End: 0700 5/4/91
Depth Start: 5,342 ft.
Depth End: 5,402 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-4-91
Spud Date: 02-04-91
Day #: 90
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,342 - 5,402 feet with approximately 70 percent return of drilling fluids. Fluid return gradually declined during the past 24 hours in fractured formation. Core runs were all 10 feet with 100 percent recovery. Bottom hole temperature measurements of 434 F were recorded at 5,352 feet and 5,402 feet. The fractured nature of the formation is permitting drilling to migrate away from the bore hole and depressing bottom hole temperatures.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,402	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/4/91
Period End: 0700 5/5/91
Depth Start: 5,402 ft.
Depth End: 5,462 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in N/A 33
Mud pH: 9.0
Mud Temp (F): IN 76 OUT 78
LC @

Date: 5-5-91
Spud Date: 02-04-91
Day #: 91
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,402 - 5,462 feet with approximately 70 percent return of drilling fluids. Core recovery is 100 percent, however the fractured and sandy intervals have resulted in core runs of 4 - 10 feet. Bottom hole temperature of 442 F was recorded at 5,455 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,462	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # 3DH-2
Period Start: 0700 5/5/91
Period End: 0700 5/6/91
Depth Start: 5,462 ft.
Depth End: 5,512 ft.
Footage: 50 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in N/A 33
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-6-91
Spud Date: 02-04-91
Day #: 92
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,462 - 5,512 feet with approximately 70 percent return of drilling fluids. Core recovery is 100 percent, however the fractured and sandy intervals have resulted in some core runs of 3 - 4 feet. Average core runs during the past 2 days has been over 8 feet. Bottom hole temperature of 445 F was recorded at 5,498 feet. Drilling fluid migration into fractured rock surrounding the borehole continues to depress measured BHT's.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,512	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/6/91
Period End: 0700 5/7/91
Depth Start: 5,512 ft.
Depth End: 5,575 ft.
Footage: 63 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-7-91
Spud Date: 02-04-91
Day #: 93
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: S.R.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper:
Foreman: Cunningham
Drill Mgr: Daymonaz

Bits:

Additional Information: Core NQ 5,512 - 5,575 feet with approximately 70 percent return of drilling fluids. Core runs were all 10 feet with 100 percent recovery with the exception of a 3 foot run with 1.5 feet recovered at 5,522 - 5,525 feet in a small, soft sandy interval. Bottom hole temperature of 471 F was recorded at 5,555 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,575	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/7/91
Period End: 0700 5/8/91
Depth Start: 5,575 ft.
Depth End: 5,638 ft.
Footage: 63 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 80
LC @

Date: 5-8-91
Spud Date: 02-04-91
Day #: 94
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,575 - 5,638 feet with approximately 70 percent return of drilling fluids. The hole encountered a dense, fine grained intrusive from 5,575 - 5,612 feet then back into fractured submarine volcanics and sediments. Core runs remained good and recovery was 100 percent. A bottom hole temperature of 468 was recorded at 5,602 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,638	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/8/91
Period End: 0700 5/9/91
Depth Start: 5,638 ft.
Depth End: 5,702 ft.
Footage: 64 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Date: 5-9-91
Spud Date: 02-04-91
Day #: 95
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: D.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,638 - 5,702 feet with approximately 70 percent return of drilling fluids. Six core runs of 10 feet and one 4 foot run, 100 percent recovery. Bottom hole temperatures of 496 F recorded at 5,658 feet and 488 F recorded at 5,702 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,702	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/9/91
Period End: 0700 5/10/91
Depth Start: 5,702 ft.
Depth End: 5,752 ft.
Footage: 50 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Date: 5-10-91
Spud Date: 02-04-91
Day #: 96
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: D.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,702 - 5,752 feet with approximately 70 percent return of drilling fluids. Core runs were 10 feet with 100 percent recovery. While attempting to retrieve the core after drilling to 5,762 feet, the wire line cable broke and the crew began tripping drill rods out of the hole to recover the core and overshot, which is all inside the drill rods. While out of the hole the bit will be replaced and the rods tripped back in. Drilling should resume at approximately noon today (May 10). The high bottom hole temperatures have resulted in rapid deterioration of the lower few feet of the wireline (3/8 inch cable). The lower 30 feet of wireline is cut off and retied every 2 - 3 days as embrittlement and fraying become evident.

A bottom hole temperature of 501 F was recorded at 5,752 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,752	N/A N/A	N/A

N

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/10/91
Period End: 0700 5/11/91
Depth Start: 5,752 ft.
Depth End: 5,762 ft.
Footage: 10 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Date: 5-11-91
Spud Date: 02-04-91
Day #: 97
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Finish tripping in hole, resume NQ coring. After coring approximately 8 feet of first core run, the rig engine suddenly died. This occured at 4 PM on May 10. On examination it was determined that the temporary repair to the blower shaft had failed. Mechanics from HT&T diesel repair were called at 5 PM and will not arrive until tomorrow morning. Crew continued to circulate down hole using auxiliary 7-1/2 x 8 mud pump.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,762	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/11/91
Period End: 0700 5/12/91
Depth Start: 5,762 ft.
Depth End: 5,762 ft.
Footage: 0 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 38 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Bits:

Date: 5-12-91
Spud Date: 02-04-91
Day #: 98
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Daymonaz

Additional Information: Mechanics from HT&T arrived at 9 AM on May 11. Fortunately the mechanics agreed to work through the night (Saturday) until the repairs were completed, they completed the repairs at 6 AM on May 12. Total repair time was approximately 20 hours. Total down time for the rig was 39 hours.

While the drilling rig was down, circulation was maintained in the hole using the auxiliary 7-1/2 x 8 mud pump which which is powered by a seperate power plant. When drilling resumed, no increase in torque was necessary to rotate the drilling rods and drilling continued without incident.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,762	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/12/91
Period End: 0700 5/13/91
Depth Start: 5,762 ft.
Depth End: 5,832 ft.
Footage: 70 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 37 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 75 OUT 78
LC @

Date: 5-13-91
Spud Date: 02-04-91
Day #: 99
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,762 - 5,832 feet with 75 percent returns of drilling fluids. Coring is proceeding well, with low torque and 10 foot core runs with 100 percent recovery. Bottom hole temperature of 506 F recorded at 5,802 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,832	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/13/91
Period End: 0700 5/14/91
Depth Start: 5,832 ft.
Depth End: 5,912 ft.
Footage: 80 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 32 out
Mud pH: 9.0
Mud Temp (F): IN 76 OUT 78
LC @

Bits:

Date: 5-14-91
Spud Date: 02-04-91
Day #: 100
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Additional Information: Core NQ 5,832 - 5,912 feet with 70 percent returns of drilling fluids. Coring is proceeding well, in competent formation with low rod torque and 10 foot core runs with 100 percent recovery. Bottom hole temperatures of 506 and 510 F were recorded at 5,852 and 5,902 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,912	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/14/91
Period End: 0700 5/15/91
Depth Start: 5,912 ft.
Depth End: 5,980 ft.
Footage: 68 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 32 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-15-91
Spud Date: 02-04-91
Day #: 101
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 5,912 - 5,980 feet with approximately 60 percent drilling fluid returns. A few angular fractures at 5,925 feet blocked the core tube and resulted in a short core run (5 feet), otherwise the formation continues to be competant with scattered fractures. Bottom hole temperature of 515 F recorded at 5,952 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 5,980	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/15/91
Period End: 0700 5/16/91
Depth Start: 5,912 ft.
Depth End: 6,041 ft.
Footage: 61 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 32 out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT 81
LC @

Bits:

Date: 5-16-91
Spud Date: 02-04-91
Day #: 102
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Additional Information: Core NQ 5,980 - 6,041 feet with 60 percent returns of drilling fluids. Formation continues to be competent with scattered fractures. Rod torque is normal, core runs are 10 feet and recovery is 100 percent. Bottom hole temperature of 527 F recorded at 6,000 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,041	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/16/91
Period End: 0700 5/17/91
Depth Start: 6,041 ft.
Depth End: 6,110 ft.
Footage: 69 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 32 out
Mud pH: 9.0
Mud Temp (F): IN 79 OUT 82
LC @

Date: 5-17-91
Spud Date: 02-04-91
Day #: 103
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Daymonaz

Bits:

Additional Information: Core NQ 6,041 - 6,110 feet with 60 percent returns of drilling fluids. Formation remains competent in submarine lava flows, small intrusives and clastic sediments. Core runs are 10 feet and recovery is 100 percent. Bottom hole temperature of 537 F recorded at 6,051 feet and 545 F recorded at 6,100 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,110	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/17/91
Period End: 0700 5/18/91
Depth Start: 6,110 ft.
Depth End: 6,171 ft.
Footage: 61 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 82
LC @

Date: 5-18-91
Spud Date: 02-04-91
Day #: 104
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,110 - 6,171 feet with 60 percent returns of drilling fluids. Formation remains competent in intrisives and submarine lava flows. Core runs are 10 feet and recovery is 100 percent. Bottom hole temperature of 558°F recorded at 6,151 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,171	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/18/91
Period End: 0700 5/19/91
Depth Start: 6,171 ft.
Depth End: 6,232 ft.
Footage: 61 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 84
LC @

Date: 5-19-91
Spud Date: 02-04-91
Day #: 105
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,171 - 6,232 feet with 70 percent returns of drilling fluids. Core runs are 10 feet with 100 percent recovery. Bottom hole temperature of 564° F was recorded at 6,201 feet.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,232	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # 80H-2
Period Start: 0700 5/19/91
Period End: 0700 5/20/91
Depth Start: 6,232 ft.
Depth End: 6,292 ft.
Footage: 60 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 32 out
Mud pH: 9.0
Mud Temp (F): IN 81 OUT 84
LC @

Date: 5-20-91
Spud Date: 02-04-91
Day #: 106
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: LaOrange
Helper: K.K.
Helper: S.R.
Foreman: Cunningham
Drill Mgr: Daymonaz

Bits:

Additional Information: Core NQ 6,232 - 6,292 feet with approximately 60 percent drilling fluid returns. Core runs continue to average 10 feet with 100 percent recovery. Bottom hole temperature of 569°F recorded at 6,252 feet.

History

Hole Size	Interval (ft)	Casing Size (interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/20/91
Period End: 0700 5/21/91
Depth Start: 6,292 ft.
Depth End: 6,350 ft.
Footage: 58 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-21-91
Spud Date: 02-04-91
Day #: 107
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,292 - 6,350 feet with 80 percent returns of drilling fluids. Formation remains competent in intrusives and submarine lava flows. Core runs are 10 feet and recovery is 100 percent. Bottom hole temperature of 578 F recorded at 6,302 feet and 585 F recorded at 6,350 feet.

The pump in the water supply well has apparently sanded in causing the pump motor shaft to shear. Haul in 2 loads of water (5,000 gal each) to top off tank and sump. With the current rate of drilling fluid loss, the water supply can be maintained with minimal trucking.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,350	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/21/91
Period End: 0700 5/22/91
Depth Start: 6,350 ft.
Depth End: 6,388 ft.
Footage: 38 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 78
LC @

Bits:

Date: 5-22-91
Spud Date: 02-04-91
Day #: 108
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Core NQ 6,350 - 6,388 feet with 80 percent returns of drilling fluids. Core runs are 10 feet with 100 percent recovery. While drilling ahead at 6,388 feet the NQ rods separated at 1,880 feet. Tripped out of hole, and fished out broken section. Trip back in hole and circulate bottoms up every 500 feet to cool hole.

Haul one load of water to top off supply.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,388	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/22/91
Period End: 0700 5/23/91
Depth Start: 6,388 ft.
Depth End: 6,455 ft.
Footage: 67 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT 81
LC @

Bits:

Date: 5-23-91
Spud Date: 02-04-91
Day #: 109
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Additional Information: Core NQ 6,388 - 6,455 feet with 80 percent returns of drilling fluids. Formation remains competent in intrusives and submarine lava flows with some fracturing in the 6,420 - 6,448 foot interval. Core runs are 10 feet and recovery is 100 percent. Bottom hole temperature of 602 F recorded at 6,418 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,455	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/23/91
Period End: 0700 5/24/91
Depth Start: 6,455 ft.
Depth End: 6,521 ft.
Footage: 66 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 35 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT 80
LC @

Date: 5-24-91
Spud Date: 02-04-91
Day #: 110
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,455 - 6,521 feet with 85 percent returns of drilling fluids. Core runs are 7 - 10 feet with 100 percent recovery. Bottom hole temperature of 608 F recorded at 6,462 feet and 610 F recorded at 6,521 feet. Three loads of water (5,000 gal each) were transported to the site. Haul one load of water to top off supply.

At 4:30 PM when the hole was at a depth of 6,491 feet verbal approval to deepen the hole below 6,500 feet, to a maximum depth of 7,000 feet, was received from DLNR.

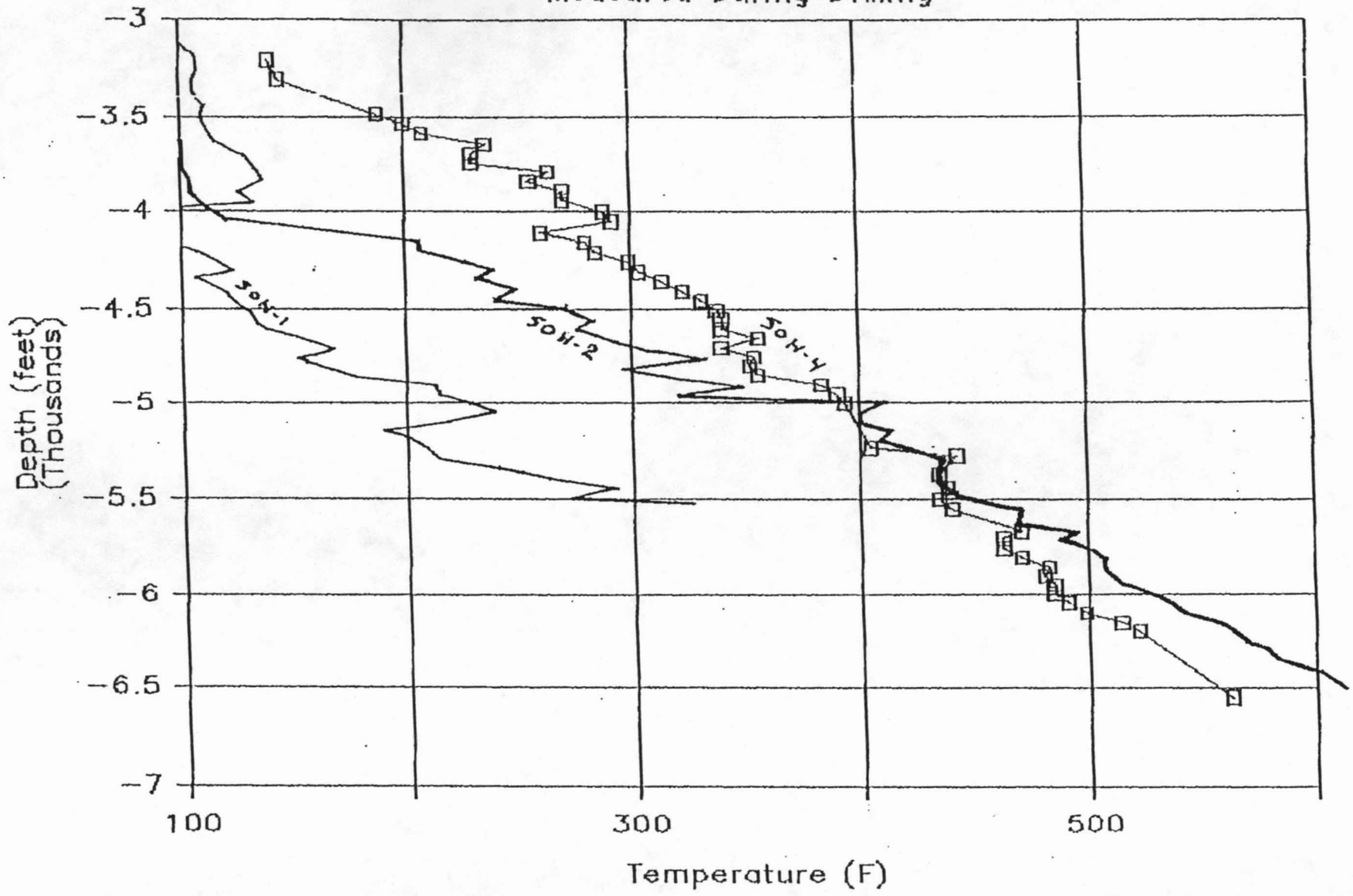
History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,521	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

SOH BOTTOM HOLE TEMPERATURES

Measured During Drilling



HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/24/91
Period End: 0700 5/25/91
Depth Start: 6,521 ft.
Depth End: 6,583 ft.
Footage: 62 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 80 OUT 82
LC @

Date: 5-25-91
Spud Date: 02-04-91
Day #: 111
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,521 - 6,583 feet with 80 percent returns of drilling fluids. Formation remains competent in intrusives and submarine lava flows with core runs of 9 - 10 feet and 100 percent recovery. The core tube had mislatched on the final core run and after the driller was unable to correct the situation the decision was made to trip out of the hole to retrieve 9 feet of core now in the rods and check the bit which has now cored 821 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,583	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/25/91
Period End: 0700 5/26/91
Depth Start: 6,583 ft.
Depth End: 6,622 ft.
Footage: 39 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 79 OUT 81
LC @

Date: 5-26-91
Spud Date: 02-04-91
Day #: 112
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Trip drill rods out of hole and recover 9 feet of core. Bit is in remarkably good shape and was run back in to complete hole. Encountered less than 6 inches of fill in hole, resumed core drilling at 5:45 PM. Core drill NQ 6,583 - 6,622 feet with 80 percent return of drilling fluids, 10 foot core runs and 100 percent recovery. Bottom hole temperature of 626 F recorded at 6,602 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2'	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,622	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/26/91
Period End: 0700 5/27/91
Depth Start: 6,622 ft.
Depth End: 6,702 ft.
Footage: 80 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 76 OUT 78
LC @

Date: 5-27-91
Spud Date: 02-04-91
Day #: 113
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: McCleod
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,622 - 6,702 feet with 75 percent returns of drilling fluids. Formation remains competent in intrusives, clastic sediments and submarine lava flows with 10 foot core runs and 100 percent recovery. Bottom hole temperature of 626 F recorded at 6,672 feet. Trucked in 5 loads of water (5,000 gal each) to build on-site supply.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,702	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/27/91
Period End: 0700 5/28/91
Depth Start: 6,702 ft.
Depth End: 6,752 ft.
Footage: 50 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 34 out
Mud pH: 9.0
Mud Temp (F): IN 77 OUT 79
LC @

Date: 5-28-91
Spud Date: 02-04-91
Day #: 114
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Core NQ 6,702 - 6,752 feet. Drilling fluid loss gradually increasing to 50 percent. Interval from 6,712 - 6,730 feet very broken, resulting in core runs of 2.5 - 7 feet. Core recovery remains at 100 percent. Bottom hole temperature of 634 F recorded at 6,752 feet.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
		5"	(0-1,794)	CHD/14.34#
3.83"	4,103 to 4,959	3-1/2"	(0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,752	N/A	N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/28/91
Period End: 0700 5/29/91
Depth Start: 6,752 ft.
Depth End: 6,802 ft.
Footage: 50 ft.
Mud Wt: 8.4 #/gal
Vis (sec): 36 in 33 out
Mud pH: 9.0
Mud Temp (F): IN 78 OUT 81
LC @

Date: 5-29-91
Spud Date: 02-04-91
Day #: 115
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Daymonaz

Bits:

Additional Information: Core NQ 6,752 - 6,802 feet with 50 percent returns of drilling fluids. Formation remains competent in intrusives, clastic sediments and submarine lava flows with 10 foot core runs and 100 percent recovery. TD hole at 1 AM 5/29/91 at 6,802 feet. Bottom hole temperature of 634 F recorded at 6,802 feet. Trucked in 5 loads of water (5,000 gal each) to build on-site supply.

Begin tripping NQ drill rods out of hole.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,802	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/29/91
Period End: 0700 5/30/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 5-30-91
Spud Date: 02-04-91
Day #: 116
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Finish pulling NQ drill rods, and begin pulling HMQ rods. HMQ rods have separated at 4,182 feet and moved approximately 10 feet further down hole.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,802	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/30/91
Period End: 0700 5/31/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 5-31-91
Spud Date: 02-04-91
Day #: 117
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Finish pulling 4,182 feet of HMQ rods and laying down in 20 foot lengths. Trip in hole with mechanical cutter and cut remaining HMQ at 4,762 feet. Trip out of hole, lay down cutter assembly, pick up Bowen spear, trip in hole and recover 580 feet of HQ rod. HQ remaining in hole from 4,762 - 4,998 feet to hole back unstable sandy interval. Begin running NQ tubing.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
		5" (0-1,794)	CHD/14.34#
3.83"	4,103 to 4,988	3-1/2" (0-4,988)	HMQ/7.7#
2.98"	4,988 to 6,802	N/A N/A	N/A

Note: 5" CHD casing and 3-1/2" HMQ casing are temporary and will be removed when hole is completed.

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 5/31/91
Period End: 0700 6/1/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Bits:

Date: 6-1-91
Spud Date: 02-04-91
Day #: 118
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Daymonaz

Additional Information: Finish running NQ tubing to TD. Remove BOPE and pull 1,794 feet of 134mm drill rod while maintaining 10 gpm flow of water into hole. Install tubing hanger and completion wellhead assembly. Prepare for logging.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # GOH-2
Period Start: 0700 6/1/91
Period End: 0700 6/2/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-2-91
Spud Date: 02-04-91
Day #: 119
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: L.N.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Additional Information: Run temperature log with USGS logging truck. Cable head failed at 6,100 feet at a temperture of 558 F. Rehead cable, run deviation survey with Eastman-Christensen gyroscopic survey tool. Eastman-Christensen engineer decided to pull tool at 5,400 feet due to excessive internal heat build-up and possible fluid leak. Survey indicates hole drifted to south at an angle of over 10 degrees from vertical at 2,000 feet, then maintained a southerly direction while slowly dropping back to a near vertical angle (less than 2 degrees) by 4,500 feet. Last measurement places hole 254 feet south and 19 feet east of well head. Projected bottom hole location places hole 270 feet south and 41 feet east of wellhead. (see attached survey record)

Install BOP and trip in hole with BQ drill rods to flush tubing.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

THE RESEARCH CORPORATION OF THE UNIVERSITY OF HAWAII
WELL: SCIENTIFIC OBSERVATION HOLE # 2
LOCATION: PUNA, HAWAII
DATE: 1-JUN-91
REF ELEV: GROUND LEVEL
TYPE: SEEKER GYROSCOPIC SURVEY
VENDOR: EASTMAN CHRISTENSEN
SURVEYOR: TOM RAY

*** SURVEY AT M.D. OF 6802' IS A PROJECTED STATION ***

RECORD OF SURVEY

MINIMUM CURVATURE METHOD

WELL: SCIENTIFIC OBSERVATION HOLE # 1 TIME DATE

LOCATION: PUNA, HAWAII 21:01:45 01-JUN-91

MEASURED DEPTH FEET	DRIFT ANGLE D M	DRIFT DIRECTION D M	COURSE LENGTH FEET	TRUE VERTICAL DEPTH FEET	RECTANGULAR COORDINATES FEET	DOGLEG SEVERITY DG/100FT
0	0 0	0 0	******	.00	.00 .00	.00
100	0 17	N 8 15 W	100.00	100.00	.25 N .04 W	.29
200	0 32	N 52 19 W	100.00	200.00	.78 N .45 W	.39
300	0 38	N 80 42 W	100.00	299.99	1.34 N 1.31 W	.13
400	0 31	N 65 13 W	100.00	399.99	1.81 N 2.21 W	.12
500	0 26	N 67 0 W	100.00	499.98	2.15 N 2.98 W	.09
600	0 23	N 80 37 W	100.00	599.98	2.36 N 3.68 W	.11
700	0 28	S 60 14 W	100.00	699.98	2.21 N 4.38 W	.30
800	0 32	S 63 49 W	100.00	799.97	1.80 N 5.16 W	.07
900	0 37	S 58 40 W	100.00	899.97	1.32 N 6.04 W	.10
1000	0 45	S 47 36 W	100.00	999.96	.59 N 6.99 W	.19
1100	0 57	S 49 23 W	100.00	1099.95	.40 S 8.11 W	.20
1200	1 16	S 59 22 W	100.00	1199.93	1.51 S 9.70 W	.36
1300	2 18	S 65 30 W	100.00	1299.88	2.91 S 12.48 W	1.06
1400	3 20	S 69 32 W	100.00	1399.76	4.76 S 17.05 W	1.04
1500	3 49	S 67 15 W	100.00	1499.56	7.07 S 22.85 W	.50
1600	4 50	S 65 44 W	100.00	1599.28	10.09 S 29.77 W	1.03
1700	5 2	S 64 12 W	100.00	1698.90	13.74 S 37.58 W	.24
1800	4 50	S 62 9 W	100.00	1798.53	17.62 S 45.27 W	.28
1900	9 58	S 3 2 W	100.00	1897.78	28.26 S 49.46 W	8.56
2000	10 19	S 1 49 W	100.00	1996.21	45.88 S 50.21 W	.41
2100	10 31	S 0 27 W	100.00	2094.56	63.97 S 50.57 W	.31
2200	9 29	S 0 38 E	100.00	2193.04	81.34 S 50.55 W	1.05
2300	9 23	S 1 49 W	100.00	2291.69	97.73 S 50.71 W	.41
2400	8 4	S 1 0 E	100.00	2390.53	112.91 S 50.85 W	1.37
2500	6 39	S 6 16 E	100.00	2489.70	125.70 S 50.09 W	1.57
2600	6 38	S 6 32 E	100.00	2589.03	137.21 S 48.80 W	.03
2700	6 1	S 6 0 E	100.00	2688.42	148.18 S 47.59 W	.62
2800	5 27	S 3 58 E	100.00	2787.91	158.15 S 46.71 W	.61
2900	4 58	S 13 18 E	100.00	2887.50	167.11 S 45.38 W	.98
3000	4 48	S 14 5 E	100.00	2987.14	175.39 S 43.37 W	.17
3100	4 20	S 15 51 E	100.00	3086.82	183.10 S 41.31 W	.48
3200	4 2	S 21 33 E	100.00	3186.55	190.02 S 38.98 W	.51
3300	3 39	S 23 48 E	100.00	3286.33	196.22 S 36.40 W	.42
3400	3 38	S 23 2 E	100.00	3386.12	202.05 S 33.87 W	.05
3500	2 34	S 34 54 E	100.00	3485.98	206.81 S 31.35 W	1.24
3600	2 48	S 46 33 E	100.00	3585.87	210.33 S 28.29 W	.60
3700	3 19	S 48 41 E	100.00	3685.72	213.93 S 24.33 W	.52
3800	2 56	S 50 50 E	100.00	3785.57	217.46 S 20.17 W	.39
3900	2 42	S 48 14 E	100.00	3885.45	220.65 S 16.42 W	.29
4000	2 36	S 50 29 E	100.00	3985.35	223.67 S 12.90 W	.14
4100	2 25	S 51 11 E	100.00	4085.25	226.44 S 9.50 W	.20
4200	2 37	S 47 42 E	100.00	4185.15	229.30 S 6.16 W	.25
4300	2 22	S 47 39 E	100.00	4285.06	232.24 S 2.94 W	.25
4400	2 23	S 43 33 E	100.00	4384.97	235.15 S .03 E	.17

LOCATION: PUNA, HAWAII 21:01:45 01-JUN-91

MEASURED DEPTH FEET	DRIFT ANGLE D M	DRIFT DIRECTION D M	COURSE LENGTH FEET	TRUE VERTICAL DEPTH FEET	RECTANGULAR COORDINATES FEET	DOGLEG SEVERITY DG/100FT
4500	1 53	S 50 10 E	100.00	4484.90	237.71 S 2.73 E	.57
4600	1 50	S 40 27 E	100.00	4584.85	239.99 S 5.04 E	.32
4700	1 36	S 40 10 E	100.00	4684.80	242.28 S 6.99 E	.24
4800	1 42	S 38 49 E	100.00	4784.76	244.51 S 8.82 E	.10
4900	1 36	S 45 5 E	100.00	4884.72	246.66 S 10.75 E	.20
5000	1 25	S 50 40 E	100.00	4984.68	248.44 S 12.71 E	.24
5100	1 11	S 59 58 E	100.00	5084.66	249.75 S 14.58 E	.32
5200	1 22	S 50 7 E	100.00	5184.63	251.05 S 16.41 E	.29
5300	1 2	S 48 49 E	100.00	5284.61	252.42 S 18.02 E	.33
5400	1 6	S 52 5 E	100.00	5384.59	253.83 S 19.48 E	.09
6802	1 6	S 52 5 E	******	6786.33	270.28 S 40.87 E	.00

FINAL CLOSURE - DIRECTION: S 8 35 E
DISTANCE: 273.36 FEET

FILE NUMBER: 001

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/2/91
Period End: 0700 6/3/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: 0 ft.
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-3-91
Spud Date: 02-04-91
Day #: 120
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: Fierback
Helper: R.U.
Helper: B.M.
Night Shift
Driller: Cunningham
Helper: S.R.
Helper: N.L.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Flush out hole with water and trip out BQ drill rods in singles (20 ft.), remove BOP equipment and install completion wellhead. Final bottom hole temperature measurement exceeded range on 650 F thermometer. Estimated reading on thermometer is 663 F at 6,802 feet.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/3/91
Period End: 0700 6/4/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-4-91
Spud Date: 02-04-91
Day #: 121
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Helper:
Night Shift (Security)
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Rig down and move equipment to HGP-A. Run day shift only with one man remaining at site during night for security.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2"	(4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4"	(0 - 6,802)	N/A

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/4/91
Period End: 0700 6/5/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-5-91
Spud Date: 02-04-91
Day #: 122
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Helper:
Night Shift (Security)
Helper: S.R.
Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Rig down equipment and move to HGP-A. Run day shift only with one man remaining on site during night for security.

History

Hole Size	Interval (ft)	Casing Size	(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8"	(0-202)	K-55/40#
8-1/2"	202 to 1,907	7"	(0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5"	(3,721-4,103)	K-55/11.5#
		4-1/2"	(1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2"	(4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4"	(0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/5/91
Period End: 0700 6/6/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-6-91
Spud Date: 02-04-91
Day #: 123
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Night Shift (Security)
Helper: S.R.

Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Move drilling rig to HGP-A site and continue rigging down remaining equipment and setting up equipment at HGP-A. Set up U.S. Geological Survey logging truck in preparation for down hole logging.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/6/91
Period End: 0700 6/7/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-7-91
Spud Date: 02-04-91
Day #: 124
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Night Shift (Security)
Helper: S.R.

Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Run temperature log with USGS logging truck and Pruett wireline/ Kuster equipment. Continue moving equipment to HGP-A and rigging up.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/7/91
Period End: 0700 6/8/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-8-91
Spud Date: 02-04-91
Day #: 125
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Night Shift (Security)
Helper: S.R.

Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Run injection test using Halliburton Services to pump water and Pruett Industries to run pressure survey. Move equipment off site and maintain night time security with one man on location.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

HAWAII NATURAL ENERGY INSTITUTE
DAILY DRILLING REPORT

Hole # SOH-2
Period Start: 0700 6/8/91
Period End: 0700 6/9/91
Depth Start: 6,802 ft.
Depth End: 6,802 ft.
Footage: N/A
Mud Wt: N/A
Vis (sec): N/A in N/A out
Mud pH: N/A
Mud Temp (F): IN N/A OUT N/A
LC @

Date: 6-9-91
Spud Date: 02-04-91
Day #: 126
Contractr/Rig: Tonto/U-5000
Day Shift
Driller: LaOrange
Driller: Cunningham
Helper: B.M.
Helper: K.K.
Night Shift N/A

Foreman: Fierback
Drill Mgr: Deymonaz

Bits:

Muds & LCM:

Additional Information: Run temperature/pressure survey with Pruett equipment. Rig down survey equipment and terminate work at SOH-2.

History

Hole Size	Interval (ft)	Casing Size(interval)	Grade/Wt
12-1/4"	0 to 202	9-5/8" (0-202)	K-55/40#
8-1/2"	202 to 1,907	7" (0-1,896)	J-55/23#
5-7/8"	1,907 to 4,103	5" (3,721-4,103)	K-55/11.5#
		4-1/2" (1,794-3,721)	J-55/10.5#
3.83"	4,103 to 4,988	3-1/2" (4,762-4,998)	HMQ/7.7#
2.98"	4,988 to 6,802	2-3/4" (0 - 6,802)	NQ/5.2#

APPENDIX C

SOH-2 COMPLAINT LOGS AND RESPONSE

Public Contact Sheet

First Contact: answering service 0
mobile phone ✓ Direct call
walk-in 0
other 0 Specify-

Date 4-9-91 Time 0938

Nature of contact: request for information ✓
complaint call ✓

Residents name: Jennifer Perry
address : Kapoho
phone number : 965-8699

Contacted by: R. Kochy Date 4-9-91 time 1030

Remarks:

Resident wanted to know what SOH was doing 0515-0530 4-9-91, Very loud.

Action taken:

Call John D. about operations - Rotary drilling only - no new or additional equip. Running. Operations unchanged for past 2 weeks. Called Resident - spoke to D. Perry and explained. Also - was a very still morning.

For: SOH

initiated by R. Kochy

date 4-10-91

Public Contact Sheet

First Contact: answering service ✓ relayed to mobile phone
mobile phone 0
walk-in 0
other 0 Specify-

Date 4-19-91 Time 1020 AM

Nature of contact: request for information 0
complaint call ✓

Residents name: Jane Hedtke
address : Kapaia
phone number : 245-7299

Contacted by, R. Koenig Date Same time Same

Remarks:

resident complained of High pitched annoying noise. didnt notice it till she went to bed (10pm) — noise was "intrusive"

I suggested noise could due to weather conditions and not a change or increase in sort equip. running. (Flat bottom clouds. In moonlight - about to rain)

Action taken:

Asked her if she wanted me to come over to take hand held measurements — She didnt feel it was necessary.

For:

SOH

initiated by R. Koenig

date 4-20-91

(7)

Public Contact Sheet

First Contact: answering service ✓ to mobile phone
mobile phone 0
walk-in 0
other 0 Specify-

Date 4-22-91 Time 607 Am

Nature of contact: request for information 0
complaint call ✓

Residents name: Jane Ihratke
address : Kapone
phone number : 905-7299

Contacted by, R. Kochy Date 4-22 time 0610 Am

Remarks:

Resident says SOH noise woke her up at 4Am –
Wanted to Know if rig was tripping
wanted to Know how much longer operations would go on
annoyed, getting sick, bad weekend
Wanted to know if Noise moniter was working
she doesn't know how much more she can take
may have to make some arrangements if this continues.
she disputed my weather prediction fri night – about to rain – claims no rain.

Action taken:

Cool damp morning – wind from North. 5-10 mph (est)
Resident says – no wind.
Called J. Deymonaz prior to phone call with resident. Operations normal no upset conditions.

For: SOH

initiated by R. Kochy
date 4-22-91

(10)

Public Contact Sheet

First Contact: answering service ✓ to mobile phone
mobile phone 0
walk-in 0
other 0 Specify-

Date 4-23-91 Time 1612 hrs.

Nature of contact: request for information ✓
complaint call 0

Residents name: Jane Hedtke
address : Kapolo
phone number : 965-7299

Contacted by, R. Kocity Date 4-25 time 1325 hrs.

Remarks:
Resident requested Dates + times of all previous complaint calls.
Wanted to know why complaints were not in Feb. monthly report.

Action taken:
List of previous complaints conveyed :
Called Lt. Glenn, Hon. about complaint listing in reports (Quarterly basis)

1. 2-26-91 1530
2. 3-3, 3-4 10pm-1Am
3. 4-19-91 2220
4. 4-22-91 0610

For:
SOIT

initiated by R. Kocity
date 4-26-91

Public Contact Sheet

First Contact: answering service 0
mobile phone 0 ✓ direct call
walk-in 0
other 0 Specify-

Date 4-26-91 Time 0040 hrs.

Nature of contact: request for information 0
complaint call ✓

Residents name: Jennifer Perry
address : Kapoho
phone number : 965-8699

Contacted by: R. Kochy Date 4-26 time 0100

Remarks:
Resident says Rig "very noisy" - "are they batching" requested noise level measurements be taken at residence, and requests that radio at rig be turned down. She also described a pump noise.

Action taken:
At res. 0100, 2 Noise data sheets taken. Very still to increasing easterly wind. 30 db Rig noise barely audible, 32 db rig clearly audible. Increasing wind had eliminated "clear" hearing conditions by 0140. Rig check 0200 - operation normal - drilling. -

For: SOH

initiated by R Kochy
date 4-26-91

Public Contact Sheet

First Contact: answering service 0 ✓ to mobile phone
mobile phone 0
walk-in 0
other 0 Specify-

Date 5-3-91 Time 0836

Nature of contact: request for information 0
complaint call 0 ✓

Residents name: Jane Hedtke
address : Kapoho
phone number : 965-7299

Contacted by, R. Kocay Date 5-3 time 0904

Remarks:

resident complained of nighttime noise 5-2-91 10 pm "annoying pitch", unable to sleep with cotton plugs in her ears. Said she checked noise monitor - reading 37 db.

Action taken:

North winds and cool air made for excellent "hearing" conditions. Notified John Deymonaz

For: SOH

initiated by R. Kelly

date 5-6-91

(17)

Public Contact Sheet

First Contact: answering service ✓ to mobile phone
mobile phone 0
walk-in 0
other 0 Specify-

Date 6-2-91 Time 0933

Nature of contact: request for information 0
complaint call ✓

Residents name: Jane Hedtke
address : Kaposho
phone number : 468-7299

Contacted by, R. Kocsy Date 6-3-91 time 1500

Remarks:

Resident complained of drill rig noise 4 Am - 6-2-91
Informed her drilling operations finished.

Action taken:

Checked with Tonto Sup. Ron. 0940 6-2-91 -
not drilling, but stringing pipe on Sat. night.

For:
SOH

initiated by R. Kocsy
date 6-3-91

APPENDIX D

NOISE COMPLAINT ANALYSIS

D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

J89-10
July 3, 1991

HAWAII NATURAL ENERGY INSTITUTE
Look Laboratory
811 Olomehani Street
Honolulu, Hawaii 96813

Attention: Ms. Laura Glenn

RE: SUMMARY OF NOISE MONITORING EFFORTS
FROM APRIL 1, 1991 THROUGH JUNE 31, 1991

Dear Ms. Glenn:

Our report dated May 7, 1991 provided a summary of noise level data recorded from January 1, 1991 through March 31, 1991. The following is a summary of noise monitoring efforts performed from April 1, 1991 to June 31, 1991.

A. OVERALL NOISE MONITORING -- Table 1 is a summary of monitoring activities, indicating that environmental noise monitoring has been performed at a total of three locations for a total of about 171 days on-line over a three month period. There are three automated noise monitoring stations (described as "A", "B" and "C") which are serviced by Alpha-Micro Systems of Hilo. Robert Kochy has also performed two manual noise level surveys in response to a specific complaint during this time period (Enclosure 1).

B. EVALUATION OF SPECIFIC NOISE COMPLAINTS -- Table 2 provides a summary of the evaluations made based on Public Contact Sheets provided to us for this quarter. The process of evaluating noise complaints involves reviewing: (a) the comments on the Public Contact Sheet; (b) the noise levels from the graphic chart recorders from monitor station "A"; (c) the information regarding the activities occurring at the rig provided in the Daily Drilling Report; and (d) the wind speed and direction information collected at the SOH #2 site. Then, the sound propagation loss condition which most likely occurred during the time of the complaint is determined in order to assess the noise impact at the complainant.

PALI PALMS PLAZA • 970 NO. KALAHEO AVENUE • SUITE A-311
KAILUA, HAWAII 96734 • (808) 254-3318 • FAX (808) 254-5295

Figures 1 through 5 are noise level strip chart recordings obtained when complaints were received. In these figures, the available noise data from the monitoring station next to the drilling rig is aligned in time with the available noise data from the station at the complainants. Five major divisions of the time scale represent 60 minutes. Noise data for Complaint Nos. 1, 3, 4 and 6 are not complete due to data loss. These are discussed separately below:

1. Complaint No. 1 -- SOH noise generated during Complaint No. 1 probably did not exceed the geothermal guidelines since only drilling activities were taking place at the time of the complaint. Previous noise data indicate that tripping activities cause higher noise levels than those of drilling, and so far no concrete evidence of exceedence exists during tripping or drilling.

   Since no data is available for Complaint No. 1, a search has been conducted to find data for the period when similar rig activity and meteorological conditions occurred. This resulted in obtaining data for May 21, 1991 (see Figure 6). Incidentally, Perry's annotations on the chart indicate that a noise complaint call was made to the rig during early morning hours of May 21, 1991, although no formal Public Contact Sheet has apparently been filed with Robert Kochy.

   The rig noise levels during the early morning hours of May 21, 1991, were mostly steady levels of about 68 to 71 dBA with a few transient events with levels ranging from about 75 to 80 dBA. Two of these transients were clearly noticeable at the Perry's monitoring station with levels ranging from about 45 to 55 dBA. This exceeds the geothermal guideline; however, due to the temporal factor in the guidelines, no violation occurred. At around 4 am, the Perry's station recorded several more transients with levels as high as 65 dBA. These transients do not coincide precisely in terms of time with those recorded at the SOH rig. Furthermore, the level difference is only about 10 dBA between the rig and the Perry's noise levels. Our sound propagation analysis indicates that even during the worst case the level difference at the two locations should be between 14 to 24 dBA. Therefore, it is concluded that geothermal guideline was not violated on May 21, 1991, and during Complaint No. 1.

2. Complaint No. 3 -- Complaint No. 3 from Hedke's, where the monitoring station had failed, involved drilling and tripping activities at the rig and both the upwind and downwind meteorological conditions. The search for data within the subject quarter with similar conditions resulted in data for April 14, 1991, which consisted of only the downwind condition (see Figure 7). As can be seen, relatively few transients were recorded at the drilling

rig. The few transients at Hedke's were at most 45 dBA and no correlation with the rig noise data exists. No geothermal violation occurred during the early morning hours of April 14, 1991. Since the meteorological conditions were worse on April 14, 1991 than during the time of Complaint No. 3, it is concluded that probably no geothermal violation occurred during the complaint time.

3. Complaint No. 4 -- As can be seen from Figure 3, the chart jammed about 1 am on April 26, 1991 at the Perry's monitoring station. A search for data with similar rig operations and meteorological conditions resulted in data for May 21 and 22, 1991 (see Figures 8 and 9). The wind condition was worse for sound propagation during this period than the actual complaint time on April 26, 1991.

   From Figure 8, it can be seen that the major events recorded at Perry's prior to 9 pm (denoted as "21") on May 21, 1991 do not correlate with the rig noise data, and are probably locally generated. Many transients were recorded between 9 and 10 pm, at both the Perry and the rig monitoring stations. There was also an annotation, probably by Perrys, noting that tripping was occurring during that time. The transient levels ranged from about 40 to 49 dBA at Perry's and about 70 to 81 dBA at the rig. The transients caused by the rig were probably audible at Perry's; however, due to the temporal factor, no geothermal noise guideline violation occurred.

   Also from Figure 8, it can be seen that at about 9:15 pm, an event lasting for about 2 to 3 minutes was recorded at Perry's with a maximum level of about 60 dBA. This event is probably locally generated since it does not coincide with any major noise events at the rig and the level difference between the rig and Perry's is less than 10 dBA. Even during the worst sound propagation condition, the level difference between the two positions is estimated to be at least 14 dBA. It should be noted that the noise events recorded at Perry's at 9:15 pm and later, may have been caused by the Perrys presence near the monitoring station. The ambient noise level at the Perry's during that time ranged from about 31 to 33 dBA. With such a low ambient level, a casual conversation or even a footstep near the monitoring station would be shown as a noticeable event on the strip chart recorder.

   As can be seen in Figure 9, several transients with levels as high as 66 dBA were recorded at Perry's between midnight and 1 am on May 22, 1991. No correlation with the rig noise data exists, and the apparent propagation loss differences are as low as about 7 dBA. These are probably locally generated and no geothermal noise guideline violation occurred.

The two 54 dBA transients recorded at Perry's between 2 and 3 am, shown in Figure 9, roughly correlate with the rig noise data. The transients recorded at the rig were 5 to 7 dBA above the steady noise, whereas the transients at Perry's were more than 20 dBA above the steady noise. Thus, these transients at Perry's may have been locally generated. In either case, no violation of the geothermal noise guidelines have occurred due to the temporal factor.

Several annotations are seen in Figure 9 on the chart paper between 4 and 5 am. One of the notes indicates that tripping was occurring, but the transients recorded at Perry's were all below the 45 dBA geothermal guideline. A couple of noise events lasting for about 2 to 3 minutes during the hour were also recorded. These do not correlate with the rig noise data and probably are generated by Perry's presence and a jet flyby as annotated on the chart. Also a chart annotation, apparently by the Perrys, indicates that the frequency weighting on the sound level meter was changed from "slow A" to "slow C" and "slow B". If either "B" or "C" setting was left on the sound level meter, the chart recordings would be invalid since the "slow A" setting is stipulated in the geothermal guidelines. Mr. Bill Berkhardt's (of Alpha Microsystems) annotation indicates that the "slow A" weighting was in use after his visit later on the morning of May 22, 1991.

4. Complaint No. 6 -- Only the noise data at the Hedke's station is available for Complaint No. 6 on June 2, 1991. The rig noise and meteorological data are not available since SOH #2 drilling was completed on May 29, 1991 and the rig did not provide continuous power to the monitoring station after that date. However, the drilling record for the complaint period indicates that USGS was performing logging surveys involving special tripping activities at night. Noise generated by such activities could readily be audible during the periods of calm, down-wind conditions. However, from our evaluation of previous data, even for the worst sound propagation condition, probably no geothermal guideline violations occurred.

   The idea of obtaining data for the USGS surveying activities at the other SOH drill sites was considered. However, it was realized that the data would not be applicable since the SOH #2 utilized an improved noise mitigation enclosure on the hydraulic motor at top of the rig as well as other shielding techniques. Such measures resulted in lower overall rig noise levels compared to those generated at the previous SOH sites.

C. INVESTIGATION TO IMPROVE THE NOISE MONITORING SYSTEM

It is recognized that there have been sporadic down times in the noise monitoring systems due to the adverse conditions under which they must operate. Paper jams in the strip chart recorder, cockroaches drinking the ink from the pens and insects building nests in the sound level meter have been most troublesome. Also, condensation and moisture build-up has caused problems with the microphone elements, pre-amplifiers and electrical connections, at times.

Improved methods for data acquisition which are less susceptible to the hazards of the sub-tropical rain forest are being investigated. Several manufacturers have been solicited to provide product information on integrated noise monitoring stations capable of measuring and storing sound pressure level and meteorological data in digital form over several days. Such a system would have to operate without the benefit of A/C power or telephone lines to transfer the data. Thus far, two responses to our request have been received and they are currently being reviewed and evaluated.

Sincerely,

Mike Sang Lee

MSL/msl

Table 1 - Summary of Noise Monitoring Activities from 4/1/91 TO 6/30/91

Location	Mon. Sta.	Data Set	Start Date	Stop Date	Days on Line	Remarks
SOH #2	A	34a	4/1	4/8	7	3 hours of data lost on 4/8, paper ran out
SOH #2	A	34b	4/8	4/19	9	No data, 4/8-10 paper jam; 8 hours of data lost during 4/17-19, no power
SOH #2	A	34c	4/19	4/26	7	
SOH #2	A	34d	4/26	5/1	2	No data, 4/26-29 paper jam
Hedke	B	34e	4/1	4/17	13	No data, 4/1-3, no power
Hedke	B	34f	4/17	4/26	4	No data, 4/17-19, 4/19-22, paper jam
Hedke	B	34g	4/26	5/1	4	No data, 4/30-5/1 pen dried
Perry	C	34h	4/1	4/17	12	No data, 4/1-3, 14 hours of data lost during 4/7-8, no data, 4/8-9, 5 hours of data lost during 4/9-10, no data 5 pm to 10 pm, 4/10, all due to paper jam; no data, 4/14-15, pen dried

Table 1 - Summary of Noise Monitoring Activities from 4/1/91 TO 6/30/91

Location	Mon. Sta.	Data Set	Start Date	Stop Date	Days on Line	Remarks
Perry	C	34i	4/17	5/1	10	19 hours of data lost during 4/20-21, no data, 4/21-22, 17 hours of data lost during 4/23-24, no data, 4/24-25 and 1 am to 8:50 am, 4/26, all due to paper jam
SOH #2	A	35a	5/1	5/6	4	No data, 5/5-6, paper ran out
SOH #2	A	35b	5/6	5/17	10	25 hours of data lost during 5/10-13, no power
SOH #2	A	35c	5/17	5/22	5	Questionable data during 5/17-20
SOH #2	A	35d	5/22	6/3	12	10 hours of data lost during 5/31-6/3, no power; end of Station A
Hedke	B	35e	5/1	5/6	5	
Hedke	B	35f	5/6	5/17	7	12 hours of data lost during 5/6-8, no data, 5/13-15, 31 hours of data lost during 5/15-17, all due to paper jam

Table 1 - Summary of Noise Monitoring Activities from 4/1/91 TO 6/30/91

Location	Mon. Sta.	Data Set	Start Date	Stop Date	Days on Line	Remarks
Hedke	B	35g	5/17	5/31	9	No data, 5/17-5/22, paper jam
Perry	C	35h	5/1	5/6	5	
Perry	C	35i	5/6	5/17	9	43 hours of data lost during 5/16-19, paper jam
Perry	C	35j	5/17	5/24	6	No data, 5/19-20, pen dried
Perry	C	35k	5/24	5/31	0	About 7 hours of data collected during this period; paper jam
Hedke	B	36a	5/31	6/19	7	24 hours of data lost during 6/5-7, 58 hours of data lost during 6/7-10, no data 6/10-14, 55 hours of data lost during 6/14-17, no data, 6/17-19, all due to paper jam
Perry	C	36b	5/31	6/17	14	38 hours of data lost during 5/31-6/2, paper jam; no data 6/9-10, pen dried

Table 1 - Summary of Noise Monitoring Activities from 4/1/91 TO 6/30/91

Location	Mon. Sta.	Data Set	Start Date	Stop Date	Days on Line	Remarks
Hedke	B	37a	6/19	6/24	5	7-1/2 hours of data lost on 6/24, 1 am until 8:30 am, paper jam
Hedke	B	37b	6/24	6/28	4	End of Station B
Perry	C	37c	6/17	6/24	1/2	No data, 6/17, 6:30 pm until 6/24, 8:30 am, paper jam
Perry	C	37d	6/24	6/28	4	End of Station C

TABLE 2 - SUMMARY OF NOISE COMPLAINTS FROM SOH #2 AND EVALUATIONS; APRIL THROUGH JUNE, 1991

No.	Date (Time)	Complainant	Complainant's Comment	Rig Operation	Rig Noise Level	Met Condition	Comments & Evaluation
1	4/9/91 (0938)	J. Perry	Resident wanted to know what SOH was doing @ 5:15-5:30 am, 4/9/91; "very loud"	Drilling	No data available	Downwind, 2 mph	Cannot evaluate directly due to lack of SOH-2 and Perry's noise data; see text and Figure 6
2	4/19/91 (2220)	J. Hedke	Resident complained of high pitched annoying noise; didn't notice it until she went to bed (10 pm) noise was "intrusive"	Drilling & Tripping	Steady level of about 70 to 73 dBA with transients of up to 76 dBA.	Upwind & transitional, 2-4 mph	Steady level of about 52 to 55 dBA @ the complainant, probably locally generated level, no correlation with the SOH-2 data, no violation; see Figure 1
3	4/22/91 (0607)	J. Hedke	Resident says SOH noise woke her up at 4 am; wanted to know if rig was tripping; wanted to know how much longer operation would go on; annoyed, getting sick, bad weekend; wanted to know if noise monitoring was working; she doesn't know how much more she can take; may have to make some arrangements if this continues; she disputed Kochy's weather condition for Fri. night- about to rain, claims no rain.	Drilling & Tripping	Steady level of about 70 to 73 dBA with transients of up to 77 dBA	Upwind & Downwind, 2-3 mph	Cannot evaluate directly due to lack of Hedke's noise data; see text and Figure 7
4	4/26/91 (0040)	J. Perry	Resident says rig "very noisy"; asking if they are "batching", requested noise level measurement be taken at residence, requested that radio at rig be turned down. She also described a pump noise	Drilling & Tripping	Steady level of about 65 to 70 dBA with one transient of 75 dBA	Downwind, 6-7 mph	Chart jam at Perry's about 1 am; existing data did not indicate violation; see text and Figure 3, 8 and 9

No.	Date (Time)	Complainant	Complainant's Comment	Rig Operation	Rig Noise Level	Met Condition	Comments & Evaluation
5	5/3/91 (0836)	J. Hedke	Resident complained of nighttime noise at 10 pm on 5/2/91; "annoying pitch", unable to sleep with cotton plug in her ear; she claims that the noise monitor is reading 37 dBA.	Drilling	Steady level of about 70 to 72 dBA. No transients during the time of complaint.	Transitional to downwind, 2 mph	Two transients of up to 60 dBA were recorded @ Hedke's, but no correlation with the SOH-2 data exists, no violation; all other data during this period were less than 45 dBA; see Figure 4
6	6/2/91 (0933)	J. Hedke	Resident complained of drilling noise at 4 am on 6/2/91.	USGS survey	No rig noise data available	No met data available	Cannot evaluate directly due to lack of rig noise and met data; see text and Figure 5

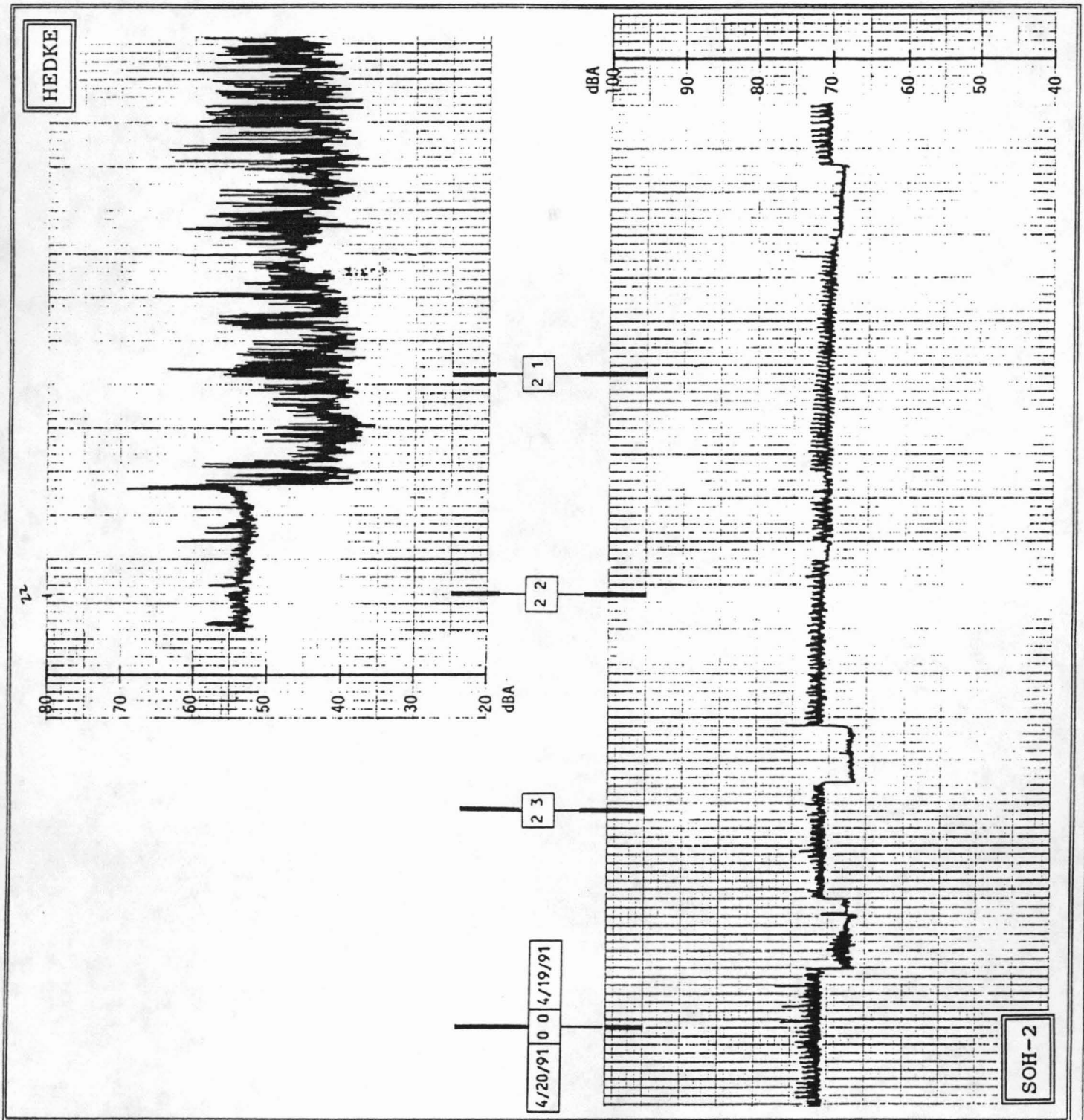


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FIGURE 1. GRAPHIC CHART RECORDINGS FOR COMPLAINT NO. 2

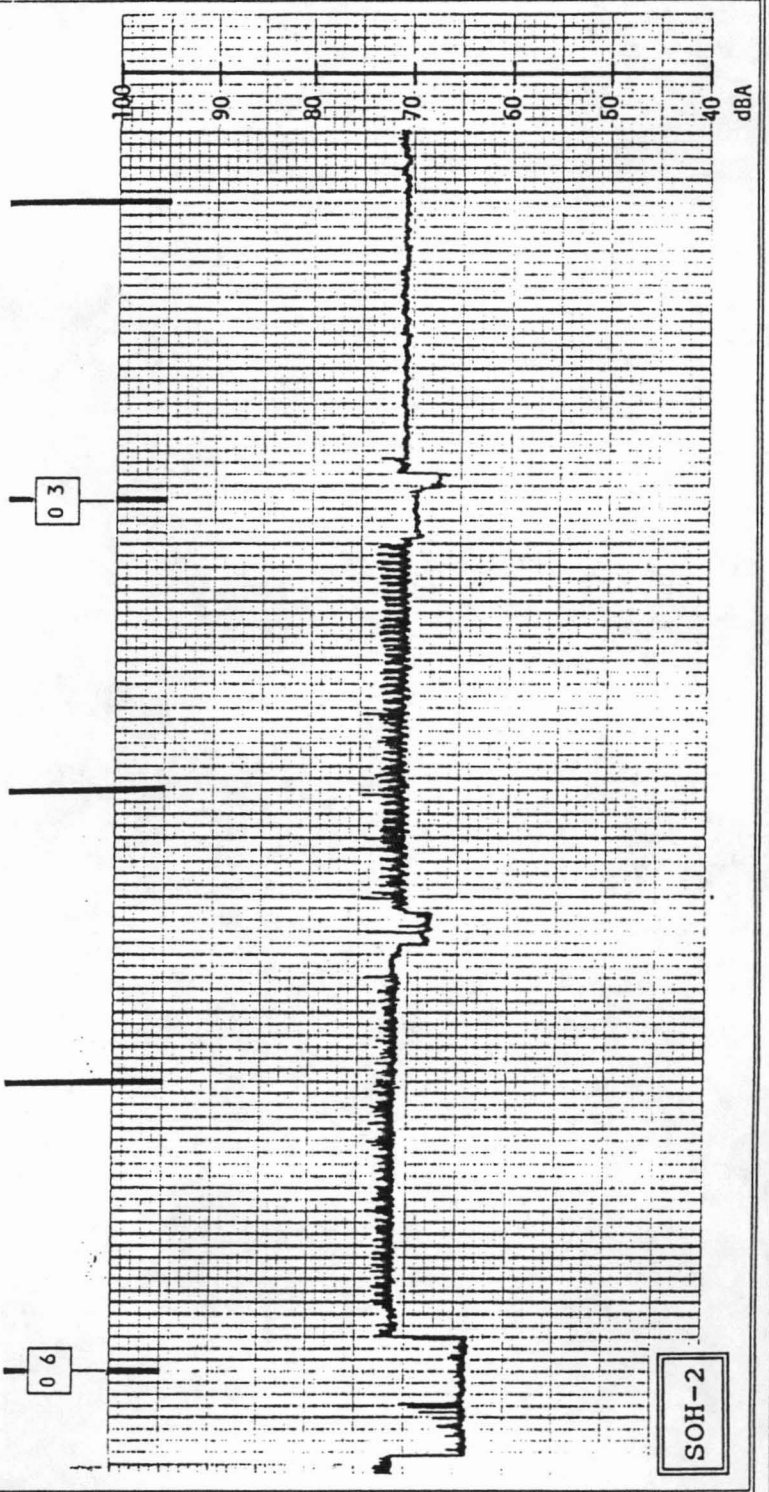

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FIGURE 2. GRAPHIC CHART RECORDING FOR COMPLAINT NO. 3, April 22, 1991

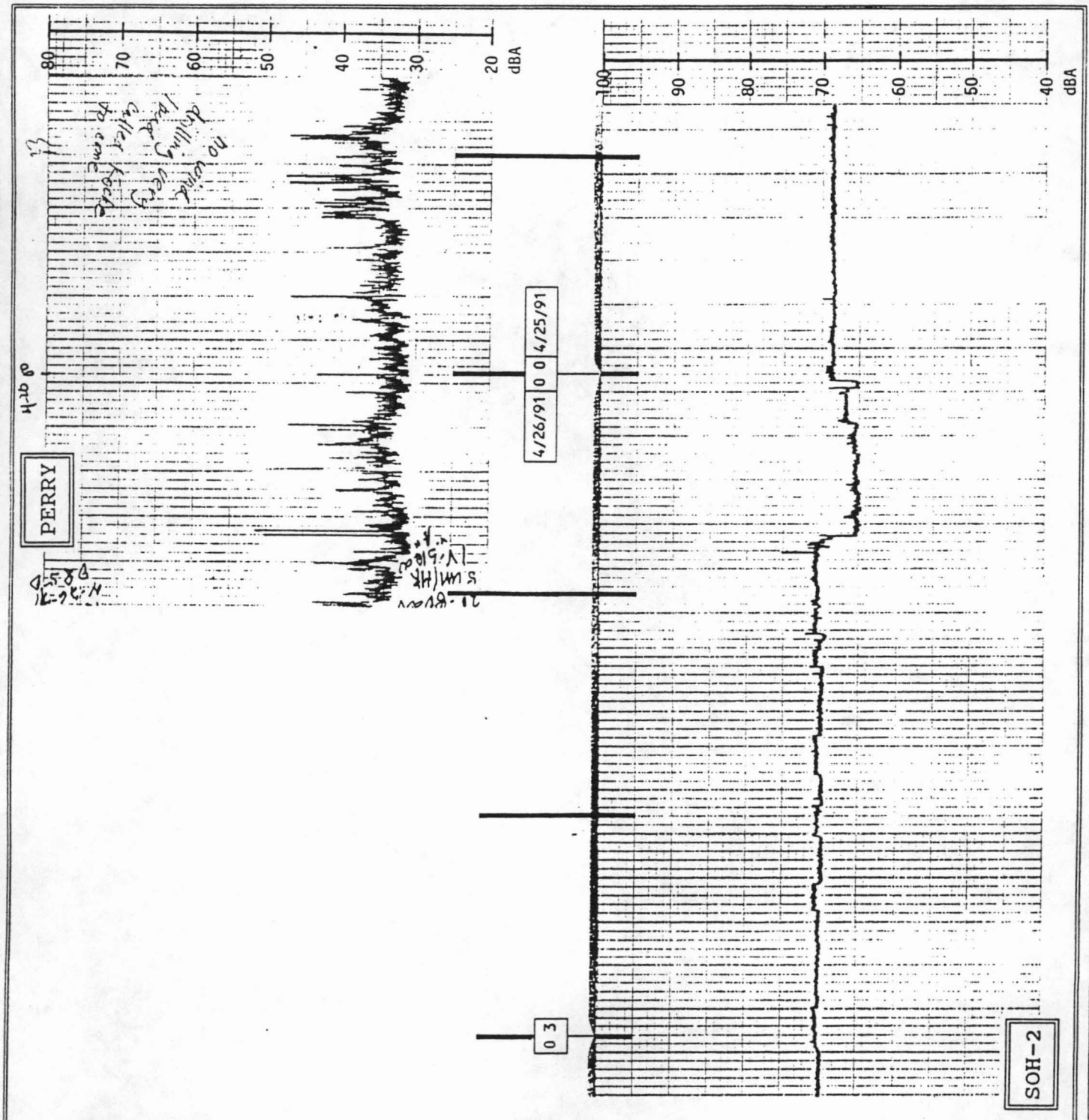

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FIGURE 3. GRAPHIC CHART RECORDING FOR COMPLAINT NO. 4

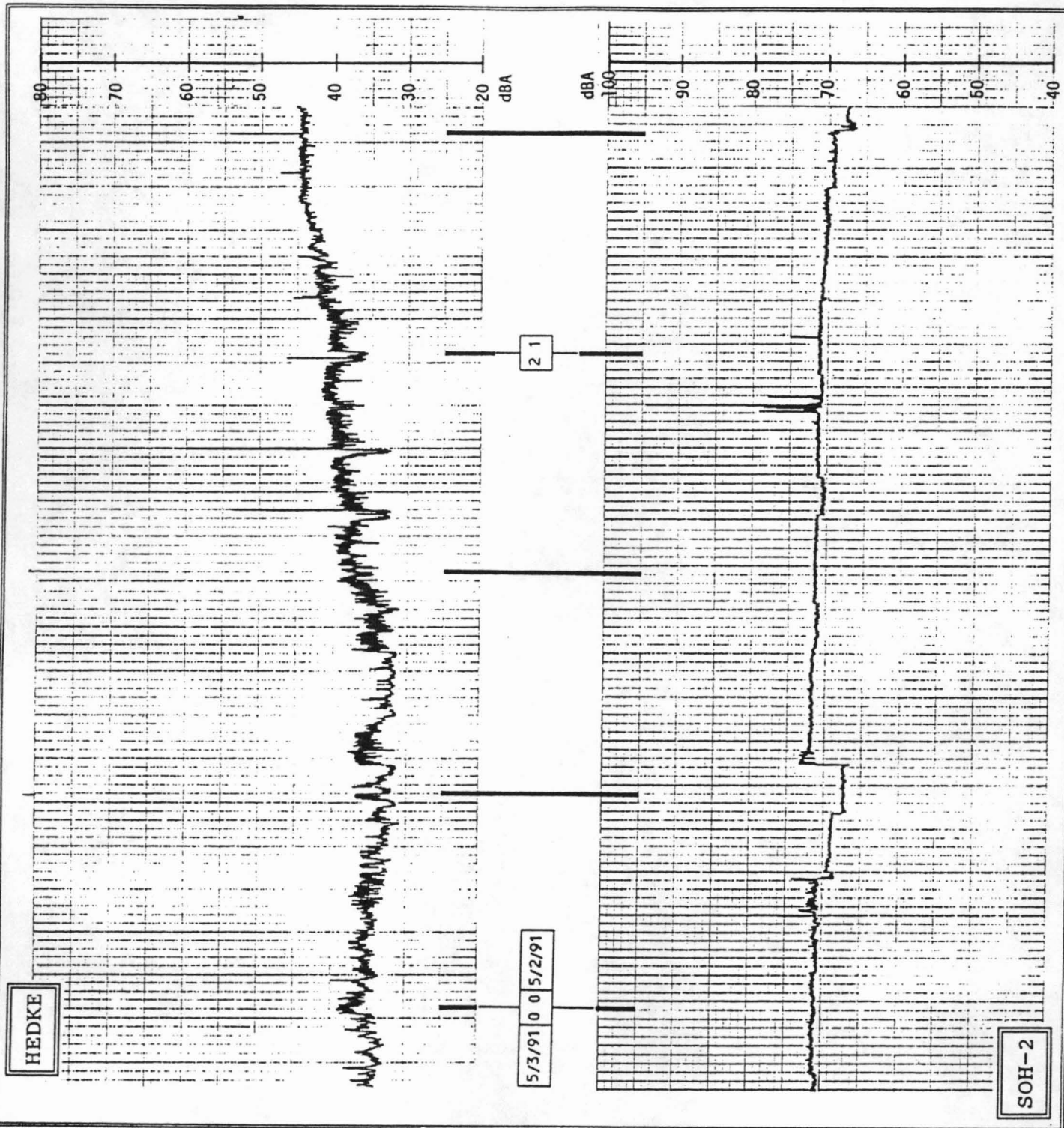

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FIGURE 4. GRAPHIC CHART RECORDINGS FOR COMPLAINT NO. 5

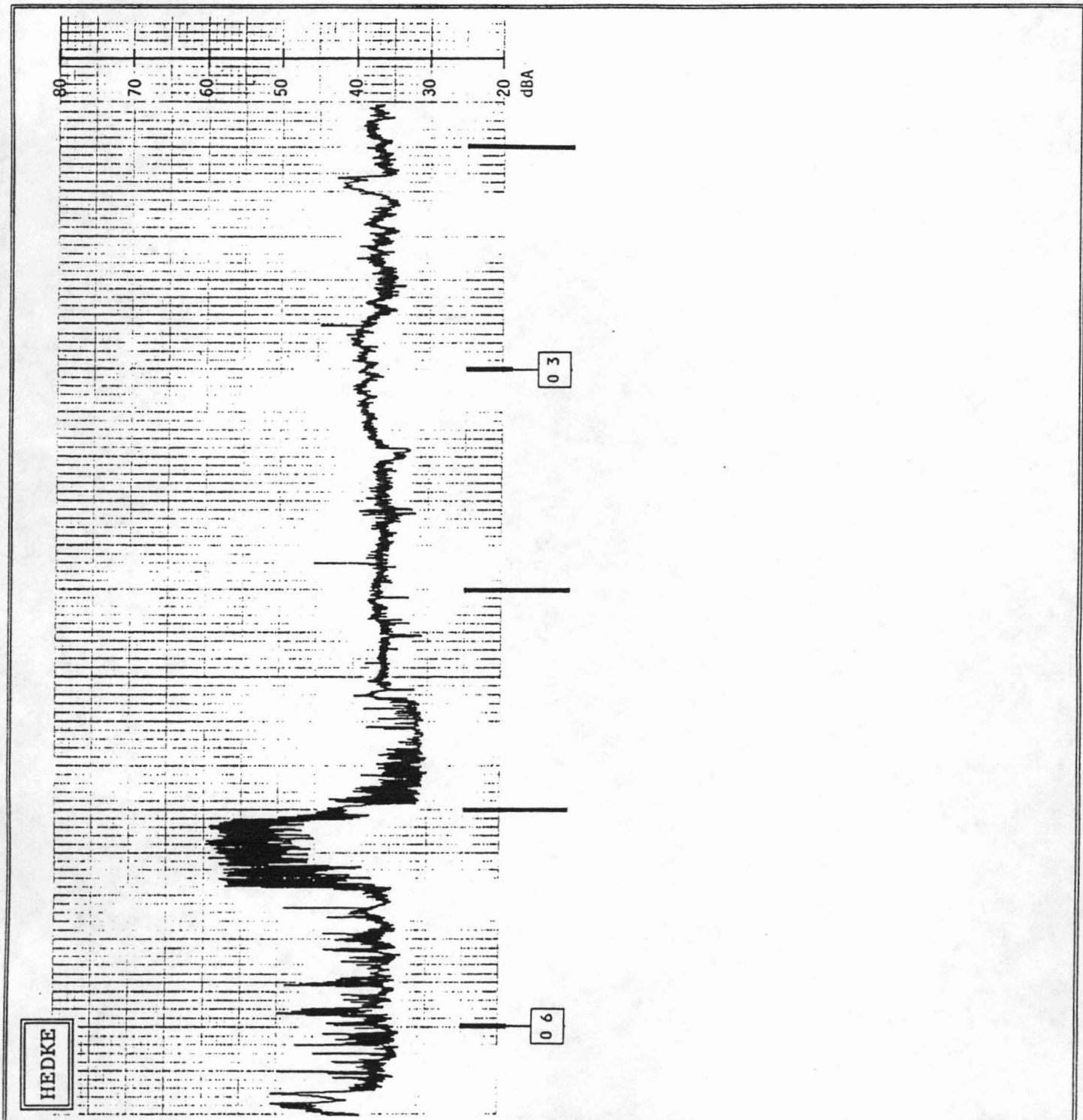

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FIGURE 5. GRAPHIC CHART RECORDING FOR COMPLAINT NO. 6

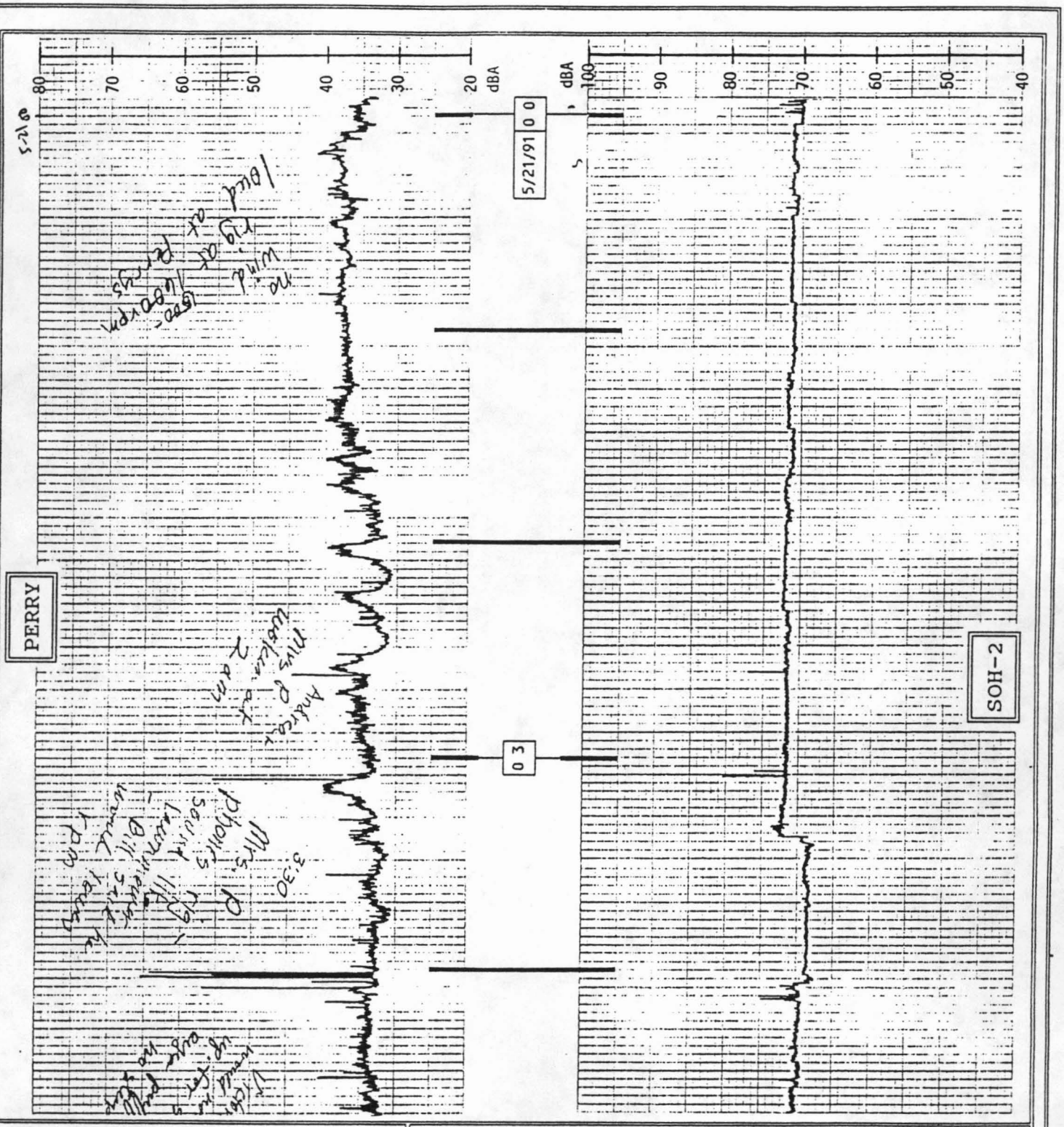

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FIGURE 6. NOISE DATA FOR MAY 21, 1991

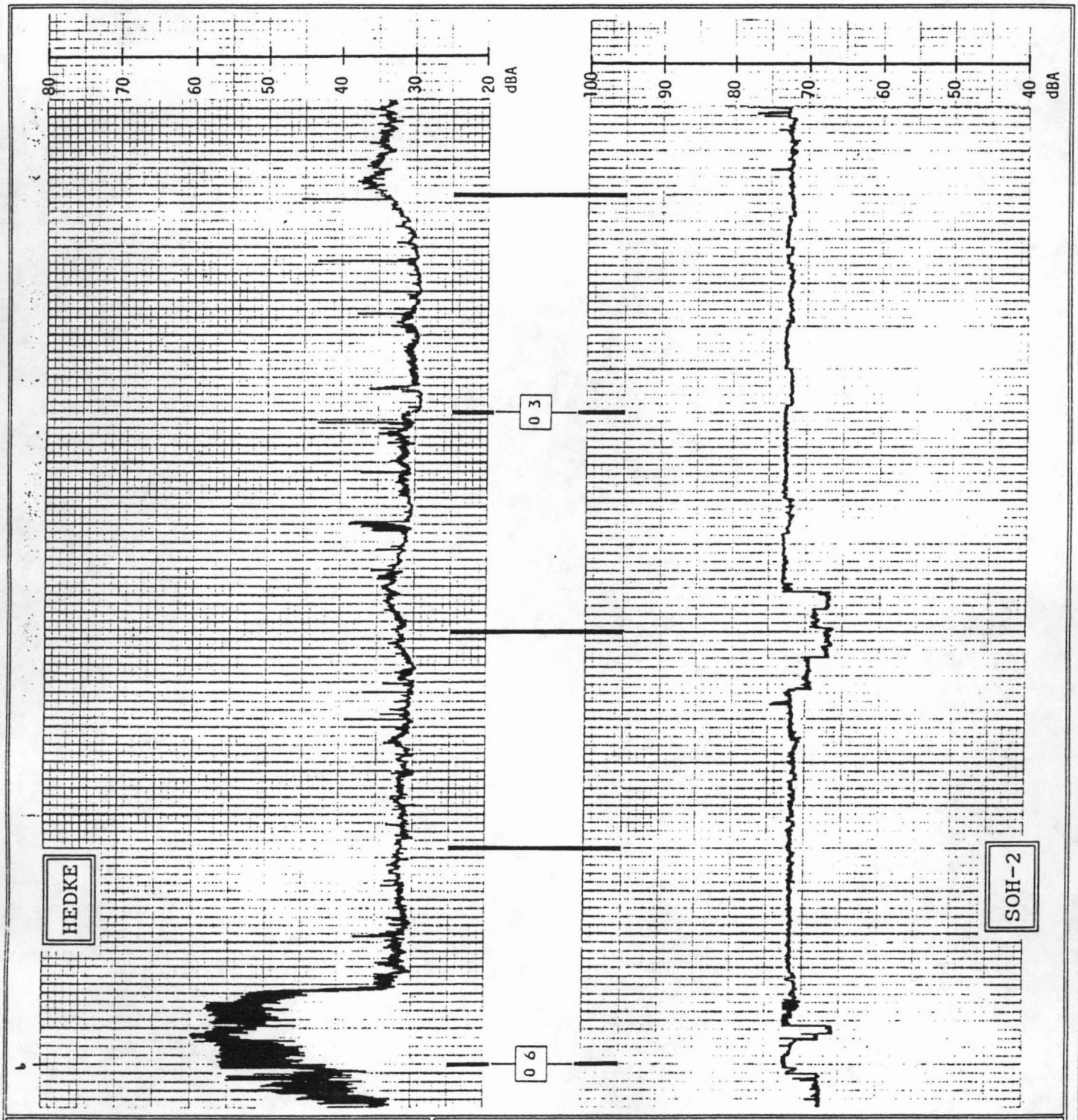

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FIGURE 7. NOISE DATA FOR APRIL 14, 1991

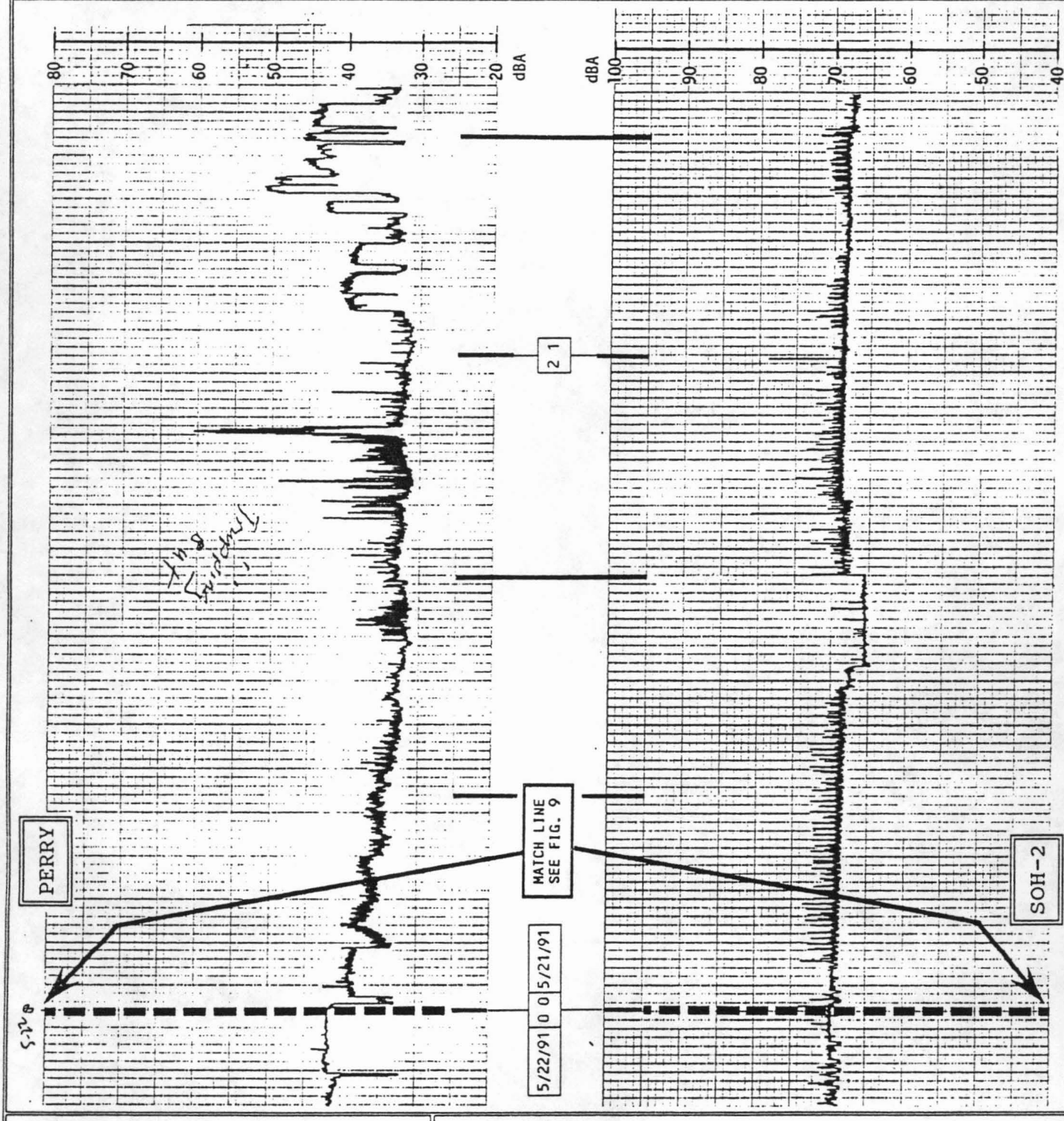

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FIGURE 8. NOISE DATA FOR MAY 21, 1991

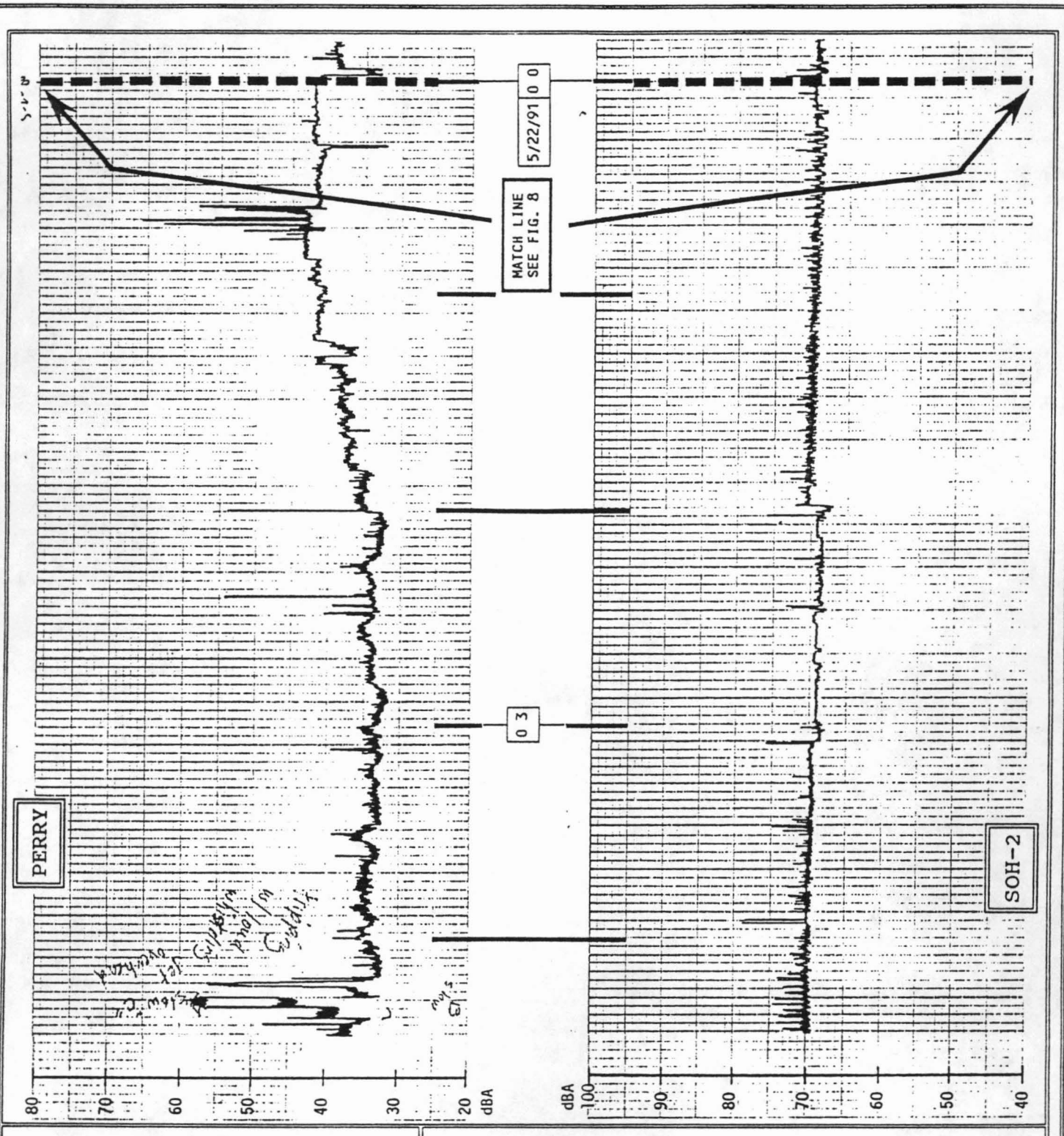

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FIGURE 9. NOISE DATA FOR MAY 22, 1991

ENCLOSURE 1

Short-Term Noise Level Measurement Results
Using Ambient Noise Survey Data Sheet

Performed by Mr. Robert Kochy
April 26, 1991
SOH-2

AMBIENT NOISE SURVEY - SOH-2
DATA SHEET

POSITION: SOH Kocity
ENGINEER: Fri
DAY OF WEEK: ~~Wed~~ DATE: 4-26 TIME: BEGIN 0107 JOB NO. _____
CAL: BEGIN _____ FINISH: 0138
FINISH: _____
SKY: Clear
WIND: none-slight
dBA L_{10}: _____
LIMITS, dBA: _____

NOTES AND SKETCH:

Ferry Res. - mr bus on fast

Drill rig Audible - 32 db

Slight wind off ocean

Car on Hwy audible

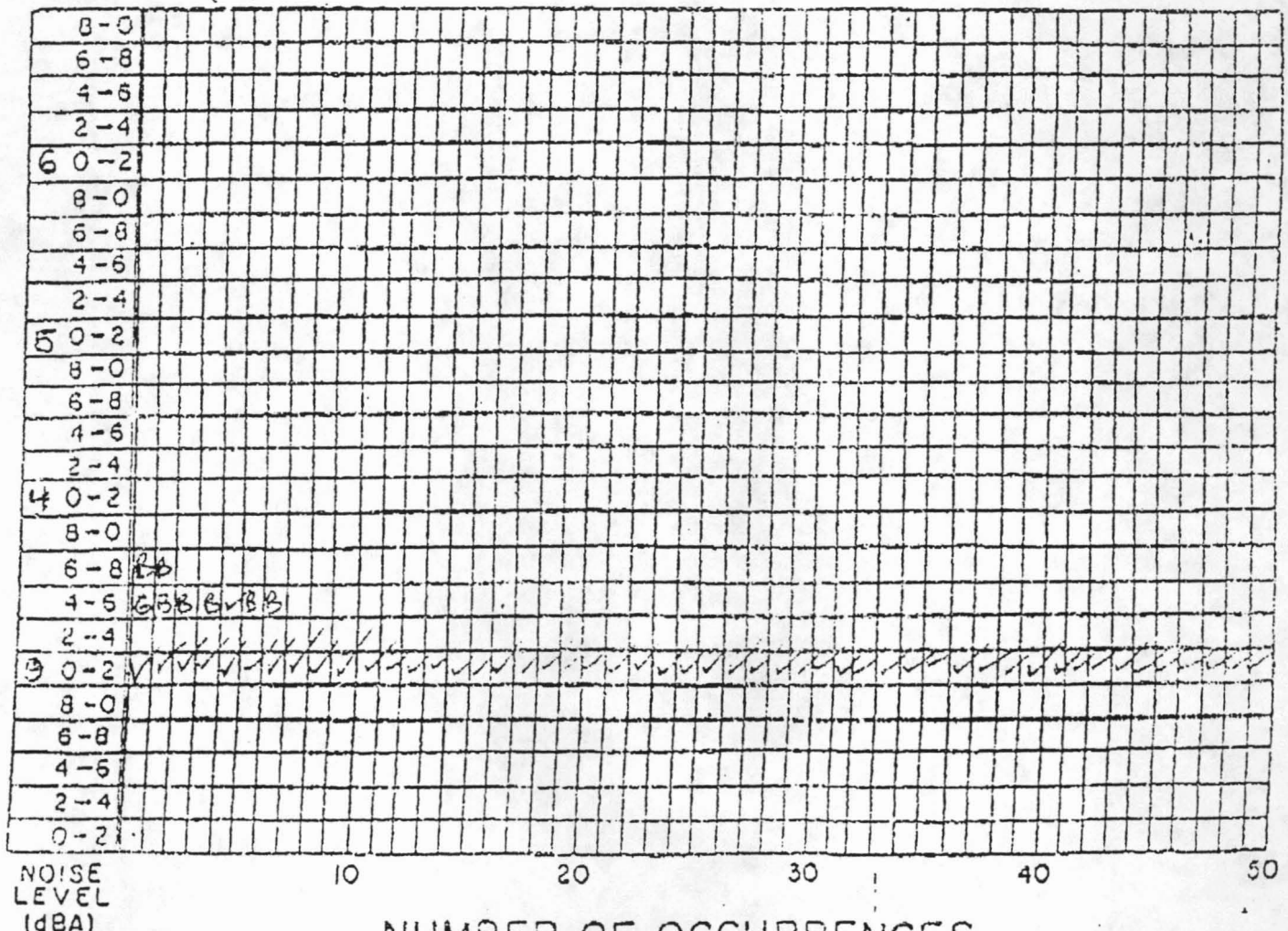
gecko in shed 35 g = gecko
B = Bird

wind in palms 33

30 no rig noise

Total # Samples	Upper Limit	L_{10}	Lower Limit
50	1st	5th	10th
100	5th	10th	17th
150	8th	15th	23rd
200	12th	20th	29th
250	16th	25th	35th
300	20th	30th	41st
350	25th	35th	47th

sample from the top



AMBIENT NOISE SURVEY – SCH-2
DATA SHEET

POSITION: SCH
ENGINEER: R. KOCHY
DAY OF WEEK: Fri. DATE: 4-26 TIME: BEGIN 0145 FINISH: 0150
CAL: BEGIN _____ FINISH: _____

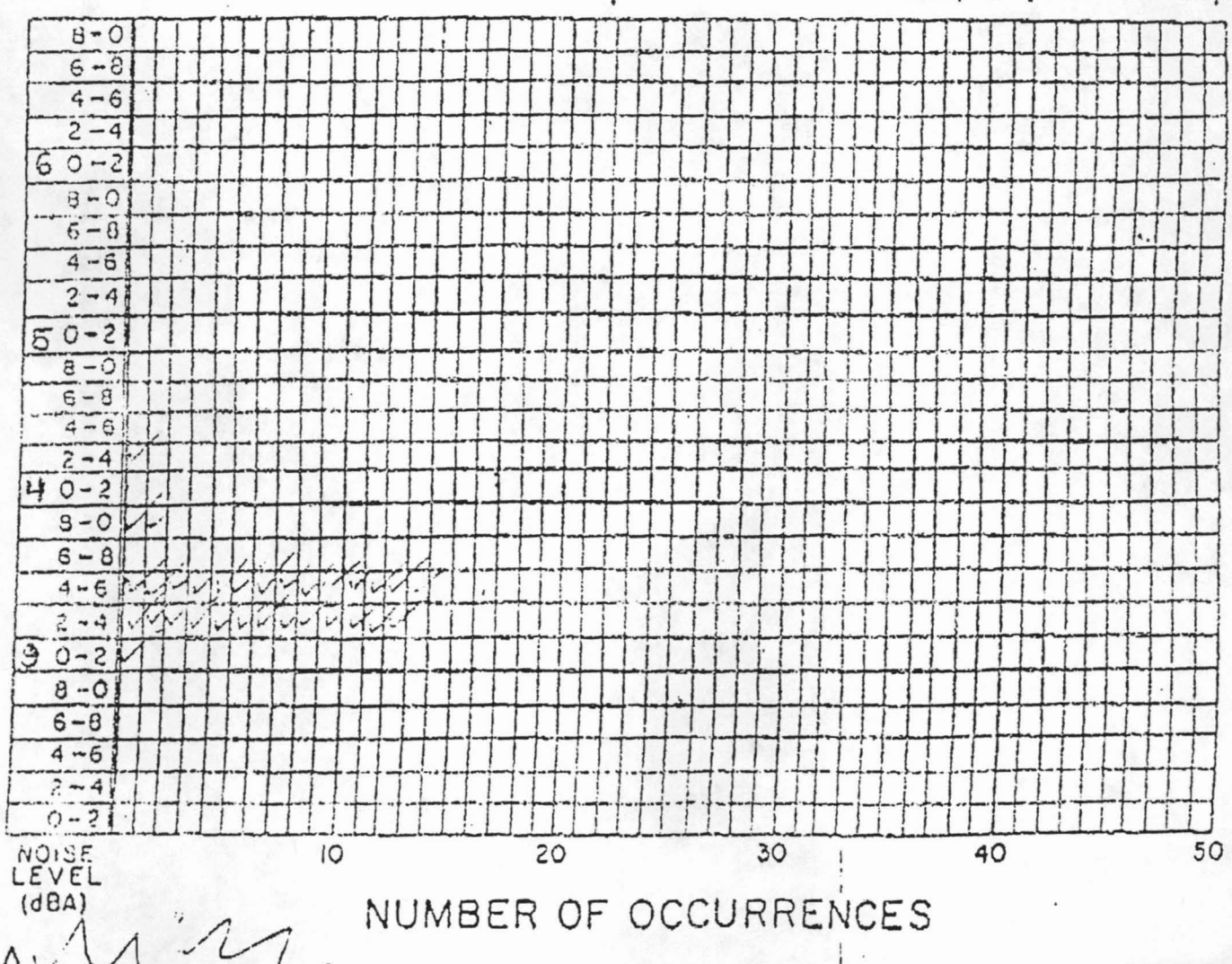
JOB NO. _____
SKY: Partly cldy
WIND: 5-7 East
dBA L_{10}: _____
LIMITS, dBA: _____

NOTES AND SKETCH:

Average - 32 dBA Audible max = 34 dBs
Wind increasing - 34-35
Trains moving 39 dBs - 44
0150 hrs wind picking up

Total # Samples	Upper Limit	L_{10}	Lower Limit
50	1st	5th	10th
100	5th	10th	17th
150	8th	15th	23rd
200	12th	20th	29th
250	16th	25th	35th
300	20th	30th	41st
350	25th	35th	47th

sample from the top



APPENDIX E

BUDGET REPORT

DBED $5,601,000
AGREEMENT FOR A GEOTHERMAL RESOURCE DEVELOPMENT, HAWAII (RCUH 3908-00)

BUDGET CATEGORY	AMOUNT AWARDED	AMOUNT EXPENDED AS OF 6/30/91	AMOUNT ENCUMBERED	AVAILABLE BALANCE
Salaries	$175,100.00	$122,100.79	$0.00	$52,999.21
Fringe	$44,400.00	$16,601.51	$0.00	$27,798.49
Equipment	$165,000.00	$130,964.81	$7,195.13	$26,840.06
Supplies	$350,500.00	$662,158.85	$32,693.51	-$344,352.36
Travel	$45,000.00	$47,682.95	$512.30	-$3,195.25
Consultant	$283,000.00	$449,671.49	$55,057.16	-$221,728.65
Publications	$0.00	$0.00	$0.00	$0.00
Miscellaneous	$162,000.00	$412,812.35	$45,684.17	-$296,496.52
Indirect Costs	$50,000.00	$50,000.00	$0.00	$0.00
Drilling	$4,326,000.00	$3,119,614.74	$170,434.93	$1,035,950.33
TOTAL	**$5,601,000**	**$5,011,607.49**	**$311,577.20**	**$277,815.31**